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Editors:
CHARLES W. PRICE. A. A. GRAY. F. H. BERNHARD.
Associate Editors:
H. FARRINGTON. H. EHRLICH. C. H. SEAVER.

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EFFICIENCY OF LIGHT SOURCES.

According to generally accepted physical doctrines, light is a form of energy; heat is a form of energy. Physicists also assert that any form of energy can be transformed into any other form of energy and that there is an accurately determinable and constant equivalent connecting the two. For instance, the English philosopher Joule determined the so-called "mechanical equivalent of heat," which is expressed by saying that so many foot-pounds of mechanical energy are equivalent to a unit of heat. Thus it would appear that one unit of heat is equivalent to so many units of light, whatever may be chosen to express this latter unit.

This problem of light efficiency is not at all a simple matter. Light as emitted by a radiant source consists of many varieties, not all of which are "visible" to the eye. Assuming the correctness of the ether theory and that light is a complex vibration of this all-pervading ether, there are some of the component parts of the vibration that are of too great a frequency, and others of too small a frequency, to produce in the mechanism of the human eye the sensation which is called light. The parts of the vibration, or, say, the component vibrations, which come within the range of the human optical apparatus, are distinguished by the colors of the spectrum, and it is only a comparatively small middle portion of the total spectrum that is available as a luminating agency.

The ideal light, to which the eye has through the ages become accustomed, is diffused daylight, and it is to this standard that light and color tests are naturally referred. Artificial illuminants do not give the same kind of light. Thus, for instance, the carbon-filament glowlamp gives a yellowish light, the mercury-vapor lamp a greenish yellow light, and the tungsten lamp a so-called white light, and it is a matter of common experience that colors as they appear in daylight, when viewed in these different lights, do not appear the same. Various artificial standards, therefore, have been devised, so that a common basis for comparison can be laid down. For the purpose of this review, the efficiencies will be measured by the watts per candlepower, without going into a discussion of what this expression really means or of its value as compared with other proposed units.

What is the ideal efficiency of light production? In other words, how many watts per candlepower will be neces-

sary and sufficient to produce a perfectly efficient illumination within the range of the visible spectrum?

An answer to the latter question is given in an article by Messrs. H. E. Ives and W. W. Coblentz, entitled "Luminous Efficiency of the Firefly," which appeared in the February, 1910, issue of the *Bulletin of the Bureau of Standards*. These investigators have spectrophometrically examined the illumination of the firefly "Photinus Pyralis," the spectrum of which was photographed on plates sensitive to the whole visible spectrum. The "luminous efficiency" of the radiation from this insect is calculated as 96.5 per cent, as compared with 0.4 per cent for the carbon-filament glowlamp, and about 4.0 per cent for the "most efficient artificial illuminant." These figures show what an enormous field of research there is open for increasing the efficiency of artificial illumination, notwithstanding the fact that the light of the firefly is poor from an illuminating standpoint.

There are some people who believe that ultimately the problem will not be wholly if at all electrical. In an address at a meeting of the Brooklyn Company Section of the National Electric Light Association, June 23, 1909, Mr. Caryl D. Haskins quoted a "very prominent American scientist" who expressed (we do not know how seriously) an opinion that if a sufficient amount of money were put behind biologists in the next twenty years, we might so improve and develop some species of phosphorescent sea animalculæ that every street lamp would be, in fact, an aquarium. But these are only prognostications, for, as the authors previously cited affirm, "There are reasons for believing that the light emitted [from the firefly] is due to a physiological-chemical reaction. * * * It should be noted that we have found the *radiant efficiency*. * * * Whether the processes of physiological chemistry * * * are equally efficient is an entirely different question."

What the electrical world is more directly concerned in at the present time is increasing the efficiency of the known electrical methods of illumination. It is a matter of common knowledge, as Dr. W. R. Whitney pointed out in his recent presidential address to the American Chemical Society, that the efficiency of filament incandescent lamps can be increased several times by so increasing the current that the filament disrupts in a few seconds. Can a filament be made so that it can withstand this higher current and consequent temperature for a length of time compatible with a life of commercial length, so to speak? Recent improvements of great moment have been made in metallic filaments, the General Electric Company in this country and two prominent electrical concerns in England having announced the early appearance of a drawn tungsten filament. Perhaps this will be able to stand a higher current than its predecessors, or perhaps some other metal or alloy will solve the problem. Meanwhile it is evident that there is room for improvement, and it goes without saying that further improvements, therefore, will be made.

POWER TRANSMISSION AT THE CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

During the last ten years the complexity of the work of the National Electric Light Association has been growing. We can remember not so long ago when such topics as fuel and gas analysis, lost and unaccounted for current, methods of metering, regulation of load factor, and analysis of costs and principles of charging occupied all the attention of the annual convention. Due to the segregating of these problems along specific lines, the literature of the conventions ten years ago was rich in classical studies of the various topics. Within recent years, however, there has been a great increase in the subjects necessitating topical discussion, and in the hurly-burly of attempting to cover more than the intellectual and physical limitations of a large aggregation of dissimilar minds would allow equally classical papers have received scant recognition and the discussion has been conspicuous for a paucity of creative thought and uplifting suggestion.

For the last two years the wisdom of arranging for parallel sessions when there might be a full and free discussion of such phases as business getting and accounting, has been demonstrated. Along this line we note with satisfaction the early announcement upon the part of the program committee of the National Electric Light Association of a strong effort which is being made to bring the subject of power transmission prominently before the convention. It is intended to have special power transmission sessions at St. Louis, and then if there appears to be the need and opportunity for the organization of a power transmission session that will be the next step in order. There will be other important work done at St. Louis during the convention, but this alone indicates the large part which the Association is taking in the art and the industry, and it is expected that this movement will receive the hearty support of all engineers and the warm endorsement of the great corporations which enjoy the benefits of advanced engineering in the utilization of our water resources.

REDUCTION GEARS FOR TURBINE-DRIVEN STEAMSHIP PROPELLERS.

With Mr. George Westinghouse in this country and the Hon. Charles A. Parsons in England working on the problem of reduction gears for turbo-driven steamships, it would seem that the electrically driven ship is destined for some time to remain much of a speculation, in spite of the good work that has already been done by Mr. W. L. R. Emmet, Mr. William P. Dartnall and others on the problem of electric drive for ships.

The Melville and McAlpine reduction gear, which was due to the initiative and fostering care of Mr. Westinghouse, has already been described in these columns, and the trial results of the United States collier which is being equipped with this gear and with turbine engines, will be eagerly

noted by all interested in the efficient propulsion of steamships.

In England, Mr. Parsons has been unobtrusively perfecting a reduction gear of the type probably first introduced by M. de Laval, and has already been able to put his invention to practical test and to compare the results with those attained by reciprocating engines directly driving the propeller shaft. These interesting experiments were recorded in a paper read by Mr. Parsons last month before a meeting of the Institution of Naval Architects in England.

The *Vespasian*, a 4,350-ton cargo vessel of nineteen feet eight inches draft, and 257 feet in length, was purchased for the purpose of the experiments, and was first fitted with triple-expansion engines of ordinary pattern, thoroughly overhauled and put into first-class condition for the trial trip from the River Tyne, in England, to the island of Malta, in the Mediterranean Sea. The greatest care was taken by a special staff of engineers in measuring the coal and water consumption on the voyage.

On returning from this trip the vessel was taken to the turbine works and the reciprocating engines were replaced by two turbines in series, one high pressure, one low-pressure, the rest of the machinery, including the boilers, remaining exactly as before. Trials were then made with the refitted vessel under the same conditions of draft and displacement as obtained on the trip to Malta.

The following comparative results are abstracted from the figures given by Mr. Parsons: At a speed of 8.87 knots per hour, the reciprocating engines used 11,750 pounds of water per hour, as against 10,750 pounds taken by the turbines—a saving of 8.5 per cent; at 9.55 knots the pounds of water per hour were 14,500 and 12,600, respectively—a saving of 13.0 per cent; at 10.2 knots, 17,500 and 14,750 pounds, respectively—a saving of 16.0 per cent.

Stated concisely, by using the turbines and reduction gear, a saving of one boiler in six is effected at the highest speed recorded above. And, furthermore, Mr. Parsons stated that his turbines weighed twenty-five per cent less than the reciprocating engines, which means that a correspondingly greater amount of cargo or coal could be carried by a vessel of the same power and speed.

It may be noted that in these trials the turbines and gear gave no trouble, there was no appreciable wear on the teeth and bearings, and very little noise or vibration was noticed.

While the contemplated further trials of the ship will be necessary to enable a reliable appraisement of the reduction gear and turbine drive to be made, there seems to be no doubt that the system is quite practicable and exceedingly efficient, and it is very possible that a revolution in present-day methods of steamship drive is imminent, especially when one takes into account the many distinguished successes that Mr. Westinghouse and Mr. Parsons have already attained in mechanical invention and application.

And, digressing a little from the subject, the important results thus far achieved with the high-speed steam turbine for driving low-speed followers through a reduction gear, open up other important fields for this remarkable form of prime mover, among which may be mentioned again the direct driving of large direct-current generators from which the turbine has hitherto been precluded by reason of the high speed at which it must operate in order to attain its highest efficiency.

THE SECOND-CLASS POSTAL RATES AGAIN.

Postmaster General Hitchcock, according to dispatches from Washington, has predicted that the first year of the present administration would show a decrease of over $10,000,000 in the postal deficit of $17,480,000 handed down from the preceding year. "The work of reorganization," Mr. Hitchcock said, "is still in progress, and I believe that with certain changes I have recommended to congress in some of the postal laws that now hamper the department it will be possible in another year to place the postal service on a self-sustaining basis, notwithstanding the tremendous losses resulting from the low rate of postage on second-class matter." Notwithstanding the masterly argument which has been made by the publishers, showing that the figures upon which it was estimated that there was a tremendous loss due to the second-class rate were misleading and erroneous, and which, according to current report, were not susceptible of substantiation, there have been recently some vigorous demands made for an increase in this rate. As these demands, however, were based upon the above-mentioned figures, they are without value except as an indication as to the extent to which this information may be used. We are glad to note that the work of reorganization now in progress is yielding such swift returns. It is for this that the periodical publishers have made their fight—a more strict adherence to business policies, and an overhauling of the system which makes the deficit possible. Postmaster Hitchcock has made a number of other suggestions which will be followed with great interest, both by the opponents and those in favor of increasing the rate upon second-class mail, notably the extending of the merit system and the establishment of civil service rules in connection with post offices of higher grade. This is a big subject and the carrying out of the proposed reforms will have a direct bearing upon the settlement of the second-class postal rate. The publishers have been accused of selfishness and of an attempt to create, or rather continue, a subsidy which imposes an inequitable burden upon all the people. They have been content to rest their case upon a thorough investigation of the whole subject, and until this investigation be made and a decision rendered there should be a withholding of argument upon the part of those not in possession of all the facts in the case.

Commission News from New York.

The Public Service Commission, Second District, has authorized the Geneva-Seneca Electric Company, operating at Geneva, N. Y., to execute and deliver a mortgage upon its property rights and franchises to secure the payment of its thirty-year 5 per cent sinking fund gold bonds to the amount of $500,000, and to issue presently bonds to the amount of $341,125, proceeds to be used, $100,000 to discharge and refund existing bonds of the Seneca-Edison Company and of the Geneva Power and Light Company; $102,900 for the payment of outstanding bonds and floating indebtedness; $75,000 for additions and betterments; and $15,000 for working capital. The bonds are to be sold at not less than eighty. The order requires that when any machinery or appliances which were owned and used by said corporation previous to the erection of the new generating station and installation of the machinery therein is retired from service, its capital account shall be credited with the value of the property to be retired and that upon issuing the bonds to the amount of $102,900 for the purpose of discharging indebtedness it shall credit its fixed capital account with the sum of $11,017.10, which sum is the amount which the Commission finds to be for replacements made with the moneys for which the indebtedness was incurred.

The commission has authorized the Catskill Traction Company, which has taken over the property of the Catskill Electric Railway Company, to issue a mortgage for $400,000 to secure the payment of five per cent to that amount and to issue presently $60,000 of its bonds at not less than eighty-five and $48,000 of its capital stock. The proceeds are to be used to purchase and acquire from W. C. Wood property rights and franchises of the Catskill Electric Company. The company is also authorized to issue $12,000 additional common capital stock to be used in payment for new pavements, changes in the company's machinery at the power plant of the Catskill Electric Company, organization expenses and working capital.

The commission has received an application from the Hartwick Power Company for authority to issue $300,000 in common capital stock; for authority to execute and deliver a first mortgage for $500,000, and an equal amount to be secured by this mortgage and for authority to acquire the steam power electric plant of the Otsego and Herkimer Railroad Company, situated in the town of Hartwick, Otsego County; to acquire from the Susquehanna River Power Company its hydro-electric development system located at Colliers, Otsego County, and a transmission line connected with said steam power electric plant at Hartwick and for approval of a contract as to power between the Hartwick Power Company and the Otsego and Herkimer Railroad Company.

The Hartwick Power Company is a new organization to take over the power plant of the Otsego & Herkimer Railroad Company and intends to consolidate it with the Susquehanna River Power Company. It has purchased all of the power franchises that were originally granted to the Oneonta, Cooperstown & Richfield Springs Railroad Company. These franchises are for light, heat and power and apply to the city of Oneonta and villages of Cooperstown, Richfield Springs, West Oneonta, Laurens, Hartwick, Fly Creek, Schuyler Lake and Jordonville.

Chicago Subway.

The first step of the receivers and reorganization committee of the Chicago Subway Company toward placing that property on a paying basis has been taken with the issuance of $3,500,000 receivers' certificates. Of this amount $3,000,000 will be used for the extension of the telephone system and $500,000 for developing the freight capacity of the Illinois Tunnel.

It is the intention of the management of the telephone branch to extend the system to a capacity of 20,000 telephones as quickly as possible. Ultimately, the capacity will be greatly increased. Charges for telephone service are to be at the rate of $85 a year for business and $50 a year for residence telephones, the number of calls being unlimited.

Interests identified with the Chicago Subway Company state that it will be at least six months before the entire plans of reorganization are taken up and passed upon by the committee in charge.

American Electrochemical Society.

Arrangements have been made for the seventeenth general meeting of the American Electrochemical Society, to be held in Pittsburg, May 5, 6 and 7 next. Headquarters will be at the Fort Pitt hotel. At the first session, annual reports will be read and several papers will be presented. During the afternoon, the delegates will visit a number of the local industrial plants. At the evening session Dr. L. H. Baekeland will deliver his presidential address. On Friday the delegates will visit a number of the industrial plants in the Monongahela valley. Saturday will be devoted to discussion of routine business.

Iowa Electrical Association.

The programme of the Iowa Electrical Association, to be held at Sioux City on April 20 and 21 has been arranged and contains some papers which promise to be very interesting.

Among the papers to be presented is one on "Regulation and Illumination" by L. B. Spinney, of Ames, Ia., and one on "Meters" by Adrian Tobias, of Lafayette, Ind. Harry G. Glass, of Pittsburg, will treat the vital problem of increasing the day load on central stations. Several other papers will be read and each session will be closed by a general discussion.

Mississippi Electric Association.

The second annual convention of the Mississippi Electric Association will be held at Greenville, Miss., June 15 and 16. There will be present at this meeting a gathering of the men interested in the electric lighting railway and power business and representing companies throughout the state of Mississippi. An attractive programme has been arranged.

Revives Old Telephone Suit.

An old telephone contest dating back fifteen years, between the National Telephone Manufacturing Company and the American Bell Telephone Company, came up before a jury in the United States District Court at Boston recently, on the former's suit to recover $500,000 for malicious persecution.

The Portsmouth company asserts that the Bell company brought a suit in 1895 based upon the alleged infringement of the Berliner patent. The Bell company lost the suit, but the Portsmouth concern says that its business was tied up so long because of the delay in the settlement of the case that it was forced out of business.

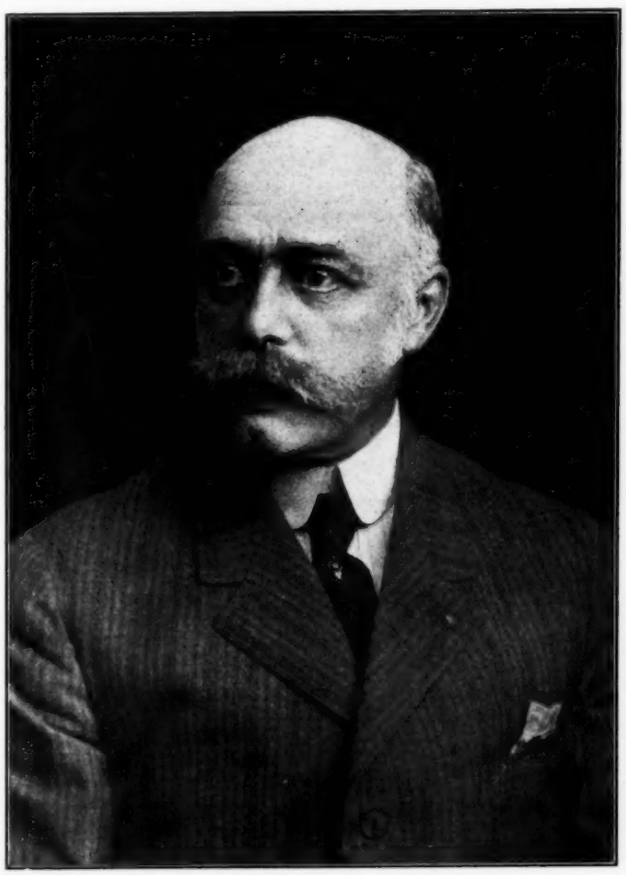
T. Commerford Martin.

Among the men who have taken an active and influential part in the early days of the electrical industry who still retain all the vitality of youth and who do honor to a wealth of experience and responsibility, Thomas Commerford Martin enjoys unique distinction. It has been the opportunity of few men to wield so important an influence in the development of a science and art, and his record of achievements as a journalist, executive and diplomat has been one of continuous achievement.

Mr. Martin was born in London, England, July 22, 1856. He was educated in England as a student of divinity, and coming to America one of his first connections with the electrical industry was his association with Edison in his laboratory from 1877 to 1879. As a journalist Mr. Martin has long been looked upon as a leader in the technical field, holding the high post of editor of the *Electrical World* from 1883 until about a year ago. He was associate secretary of the American Institute of Electrical Engineers in 1884-1885, a manager, 1885-1887; president, 1887-1888; vice-president, 1888-1890. In addition to his connection with the officiate of the Institute, he has always been a leading spirit in the development of plans looking to the elevation of the standard of electrical engineering, and his monumental work in connection with the Land and Building Fund will always be remembered. It was of him that Andrew Carnegie, on the occasion of the great library dinner, remarked that much of the success of the Engineering Societies building, the magnificent housing of the National Engineering societies of the United States was due to the "irrepressible and irresistible Martin." In many other ways he has served the fraternity of electrical engineers in a most useful and commendatory fashion.

For many years Mr. Martin has served the United States census office as a special expert, gathering together the most comprehensive and useful statistics bearing upon the electrical and allied manufacturing industries. As an honorary member of the National Electric Light Association and a member of many important committees, he has become one of the leading authorities on central station questions, and his "Progress Report" has become classical in the literature of this organization.

When with the great growth which has come to the National Electric Light Association within recent years, it became apparent that an executive officer of great attainment, who could give his entire time to the management of the important functions which have grown up within the organization was necessary, a survey of the field for that one best fitted by natural ability and association logically suggested Mr. Martin as the fitting incumbent for the post of Executive Secretary. The great possibilities of useful work which might be accomplished by the association made ready a field for the mature judgment which Mr. Martin had been developing throughout his entire connection with the industry which the association very typically represents. Upon the occasion of his retirement from active journalistic effort, he was tendered a most sincere appreciation by the journal upon the staff of which he had been so long and faithfully associated.



T. COMMERFORD MARTIN,
Executive Secretary of the National Electric Light Association.

Mr. Martin has contributed liberally to the literature of the industry, and he is the author of "The Electric Motor and Its Applications," "Researches of Nikola Tesla" and "A Life of Edison." He is a member of the New York Electrical Society, a life member of the Iron and Steel Institute, a member of the British Institution of Electrical Engineers, of the New York Academy of Sciences, of the Franklin Institute, of the Academy of Arts and Sciences, of the National Civic Federation, and a past president of the Engineers' Club.

As a lecturer he is a most finished and forceful speaker, and as a toastmaster he has few peers in any walk of life, his masterly and graceful handling of the after dinner delights having long been a most enjoyable part of the annual gatherings of several of the national engineering societies.

Since assuming the post of executive secretary of the National Electric Light Association Mr. Martin has been a conspicuous figure at many state conventions of central station men, outlining the work of the National Association and indicating the benefits accruing through adhesion to this body. He is now taking an active part in arranging for the convention which will be held in St. Louis, May 23-28, where it is expected in connection with the twenty-fifth anniversary of the organization of the association one of the greatest gatherings of electrical men in the history of the industry will be held. Due to the rapid growth of the association within the last few years the feature of recent conventions to set aside special sessions for the consideration of topical subjects will be enlarged upon.

National Electrical Jobbers Convention.

The National Electrical Jobbers' Association held its annual convention at Richmond, Va., last week, headquarters being established at the Jefferson Hotel. There was a large attendance of electrical men from all parts of the country, and although a formal program was dispensed with, there were many important conferences held during the meeting. Franklin Overbagh, president of the Overbagh & Ayres Manufacturing Company, Chicago, Ill., was re-elected president of the association.

On Thursday evening the Sons of Jove held a rejuvenation, initiating a class of forty-three.

Following the convention a conference of sales representatives of the Western Electric Company, from all parts of the world, was held.

Among those present were the following:

W. S. P. Mayo, W. B. Catlett, W. B. Jennings, W. B. Chandler, Julian Binford, Jr., Peter Winston, Roy Speights, R. E. Gorton, S. S. Weiseger, A. J. Binz, H. F. Holland, Charles Winston, L. L. Ledwell, John H. Latham, C. C. Bodeker, J. F. Leonard, J. C. Warren, Jr., Edward A. Loomis, H. B. Kirkland, H. R. Brereton, James J. Wesnow, Alton E. Williams, P. F. Bauder, John J. Myer, James A. Lincoln, W. E. Stephenson, William H. Jenks, Oscar C. Turner, F. V. R. Smith, Louis Greisser, Charles Thomas, John J. Johnson, W. B. Buchanan, Thomas A. Burke, Frederick B. Uhrig, R. L. Wildauer, D. M. Stearns, A. W. Dutton, A. L. Hallstrom, Thos. C. Ringgold, S. H. M. Agens, H. C. Lucas, C. H. Kelley, F. M. Byrne, Henry T. Paiste, R. M. Morris, W. N. Matthews, W. S. Sisson, W. I. Wallace, Charles F. Boynton, Ralph T. Rossi, Howard W. Hall, Thomas H. Green, Conrad Young, Harry Winder, Chauncey L. Hight, James A. Vaughan, Charles H. Talmadge, Frank L. Hawkins, Victor C. Gilpin, **Franklin Overbagh**, A. E. Duclos, B. H. Scranton, Lane Schofield, W. R. Thomas, C. A. DuBosch, Henry C. Hauck, Leland I. Miller, S. B. Condit, G. M. Stewart, S. W. Kraymer, E. B. Latham, George L. Patterson, Frank M. Pierce, Edgar Whitmore, F. D. Masterson, C. E. Robertson, Louis Wintner, Henry R. Worthington, Thomas M. Debevoise, Frank Stout, W. I. Otis, Thomas G. Grier, Edwin C. Graham, W. J. Tonkin, P. Moore Fletcher, Frank L. Bernardin, Edward R. Grier, William R. Herstein, M. I. Berger, C. M. Crofoot, H. I. Sackett, L. K. Cushing, V. C. B. Wetmore, Charles F. Hoyt, John C. Davidson, Bertram M. Downs, Frank V. Bertram, I. E. Berger, Howard M. Fratz, Fred B. Gleason, Charles A. Newning, Henry P. James, Herbert O. Phillips, John C. Lott, Alfred D. Trempe, Milton Mill, James A. Pizzini, Frank E. Watts, G. B. Griffin, Thomas H. Bibber, Albert F. Hills, M. L. Foster, Jr., Henry L. Walker, Martin L. Oberlander, Earl M. Jones, A. P. Eckert, Charles J. Purdy, H. W. Bliven, Edward G. Mack, Charles M. Parr, Percy R. Frost, Sam A. Hobson, N. C. Cotabish, Frank S. Price, Thomas E. Tynes, Herman S. Reams, Edward A. Loomis, James H. Cranshaw, Jr., Charles Thomas, Robert Kuhn, Adam S. Tarr, H. H. Cudmore, Alton E. Williams, P. S. Klees, Leon V. Garron, Fred S. Baldwin, John W. Brooks, Albert S. Tanner, George W. Elliott, Henry S. Wilson, Frederick E. Stowe, F. B. Lawton, R. E. Schaulin, J. C. Bradley, M. H. Jones, L. McBreen, C. E. Rundell, Wm. C. Benbow, M. G. Goldbach, F. B. Thompson, S. Morris, F. H. Menil, P. J. Aaron, R. W. Nicol, C. O. Reed, R. M. Babbitt, F. A. Kitchan, C. N. Trump, P. H. Rutter, J. R. McNaughton, W. T. Conn, C. B. Hawley, D. C. Hemingray, E. E. Hudson, N. L. Walker, Wm. J. Millard, H. L. Stroebel, M. H. Moffett, F. W. L. Fullerton, W. F. Field, A. Dunlay, C. P. Hill, W. J. Doherty, H. C. Berry, R. Ackerman, Wm. A. Browne, C. Walton Jones, Fred V. Bennis, Jos. Ed. Swisher, Wm. S. Patterson, C. R. Baldwin, Chas. F. Schondleman, Frank C. Teal, H. D. Seers.

Chicago Educational Institutions Repudiate Wireless Telephone Exploitation.

In the course of a lecture on the wireless telephone before the Lewis Institute, Chicago, Ill., Prof. F. A. Rogers, the Lewis Institute wireless expert, stated that he had been quoted in recent advertising matter of a company exploiting a certain form of wireless telephone as endorsing the system as a practical and commercial apparatus. He stated emphatically that he had never endorsed any system of wireless telephony, and that Dean Raymond of Armour Institute, Doctor Milliken of the University of Chicago, and Dean Woodworth of Lewis, had also made emphatic denial that they had endorsed the system in any way.

Michigan Power Merger.

The plan for the organization of the Commonwealth Power, Railway and Light Company, of Michigan, which was put out tentatively on December 10 last, was declared operative a short time ago.

This represents bringing together under a single control the gas, traction and electric light and power interests in Michigan of Hodenpyl, Walbridge & Company, E. W. Clark & Company and W. A. Foote. Grand Rapids capitalists are interested either as holders of the securities of the constituent companies or as subscribers to the underwriting to an amount said to be in excess of $1,000,000.

The Commonwealth Power, Railway and Light Company is organized under the laws of Maine as a holding company, capitalized at $6,000,000 preferred and $12,000,000 common stock. The securities to be issued will in part be exchanged for the common stock in the Grand Rapids company, the Saginaw-Bay City Railway and Light Company, the Michigan Light Company, which is made up of gas properties at Kalamazoo, Jackson, Pontiac, Saginaw, Bay City and Flint, the Cadillac Water and Light Company, the developed and undeveloped water power on the Muskegon, Kalamazoo, Grand and Au Sable rivers, and electric distributing plants in Grand Rapids, Saginaw, Bay City, Kalamazoo, Battle Creek, Jackson and a number of other cities. The company will have in the treasury after the exchange is made $1,150,000 cash, $300,000 of the six per cent preferred stock of the Consumers' Power Company and $200,000 of Michigan Light preferred stock, to be used for development purposes, construction work, building transmission lines and working capital.

Bill for Wire Control.

New York Assemblyman Merritt on April 11 introduced a bill at Albany, which, if enacted, will place the telephone and telegraph lines of the state of New York within the jurisdiction of the Public Service Commission of the Second District.

Power is given to the commission upon complaint or upon its own motion to issue orders in relation to rates and service. This authority, the bill stipulates, shall not be construed as giving the commission power to make an order requiring a telegraph or telephone company to perform any act which is unjust or unreasonable or in violation of the requirements of its franchise or of any State or Federal law.

The commission receives the power of investigation and limited control over the forms of accounts and records of the companies, which are required to file annual reports with the commission.

The measure contains provisions against discrimination in rates. It prohibits any corporation or association other than a telephone or telegraph company to acquire more than ten per cent of the stock of any telephone or telegraph company. The bill prohibits the granting of reduced rates or free passes or franks for transmission of any messages except by officers of or employees of the companies.

The bill requires that the permission and approval of the commission shall be given for issues of stocks and bond issues, except that companies may issue notes payable otherwise than on demand for proper corporate purposes without the approval of the commission, and notes to be payable at specified periods of not more than twelve months.

The San Paolo Power Plant.

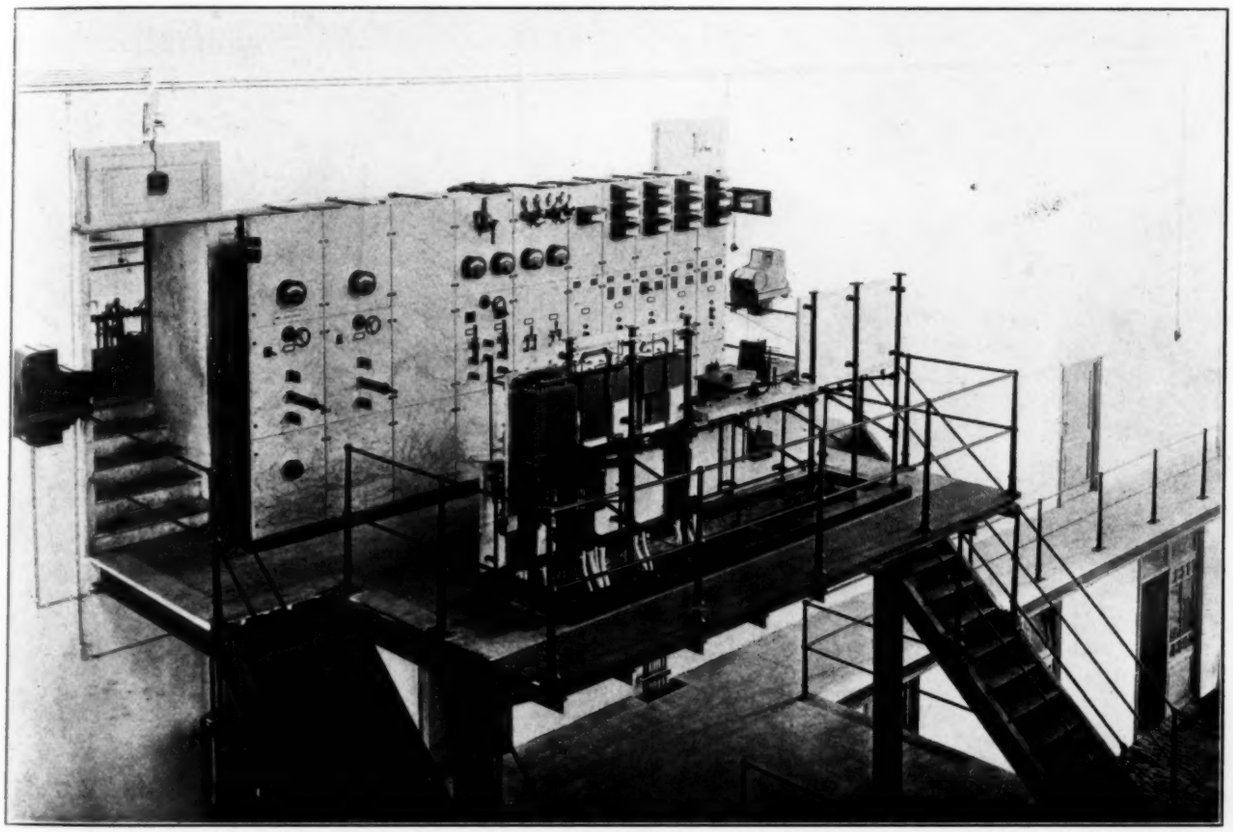
A Turbine-Driven Central Station for Rome, Italy.

BY C. L. DURAND.

The city of Rome is now securing an additional supply of current from a new electric plant which has been recently erected. It is a steam turbine plant, and is known as the San Paolo station, being located outside the city limits upon the bank of the Tiber, and is one of the largest and best laid out plants in Italy. The Anglo-Roman Gas and Electric Company owns the station, and it has already been in successful operation for some time. All the electric outfit is furnished by the Paris Thomson-Houston Company, to whom the author is indebted for the following facts:

Up to the present time the lighting current for the city of Rome was furnished by the hydraulic plants of Tivoli and Subiaco and by the steam plant of Cerchi. On account of the rapid development of the Anglo-Roman Company's operations, these stations have become insufficient to supply the amount of current which is needed at present and there is no doubt that the demand for current will continue to increase, so that it became necessary to erect a steam plant in the immediate suburbs of the city so that it could be operated in parallel with the existing stations at periods of heavy load and also serve as a standby for the hydraulic plants. The present San Paolo plant will soon be insufficient in turn and measures are already being taken to increase its output. At present there are two Curtis turbine sets installed which give a total output of 6,000 to 7,000 kilowatts. In view of a future increase, the company purchased a large extent of ground lying on the San Paolo route and on the border of the Tiber for the construction of the present station as well as for its new gas works. There will be many advantages from the proximity of the electric and the gas plants, and besides the river furnishes an abundant supply of water for the condensers.

The two Curtis turbines of 3,000 kilowatts each are supplied by a boiler plant containing twelve boilers which are provided with superheaters and economizers. In view of a probable enlargement of the station, the buildings have been laid out so as easily to double the number of turbine groups, and the dynamo room and the annex building which contains the accessory machines, etc., have been constructed accordingly.



MAIN SWITCHBOARD IN SAN PAOLA PLANT, ROME, ITALY.

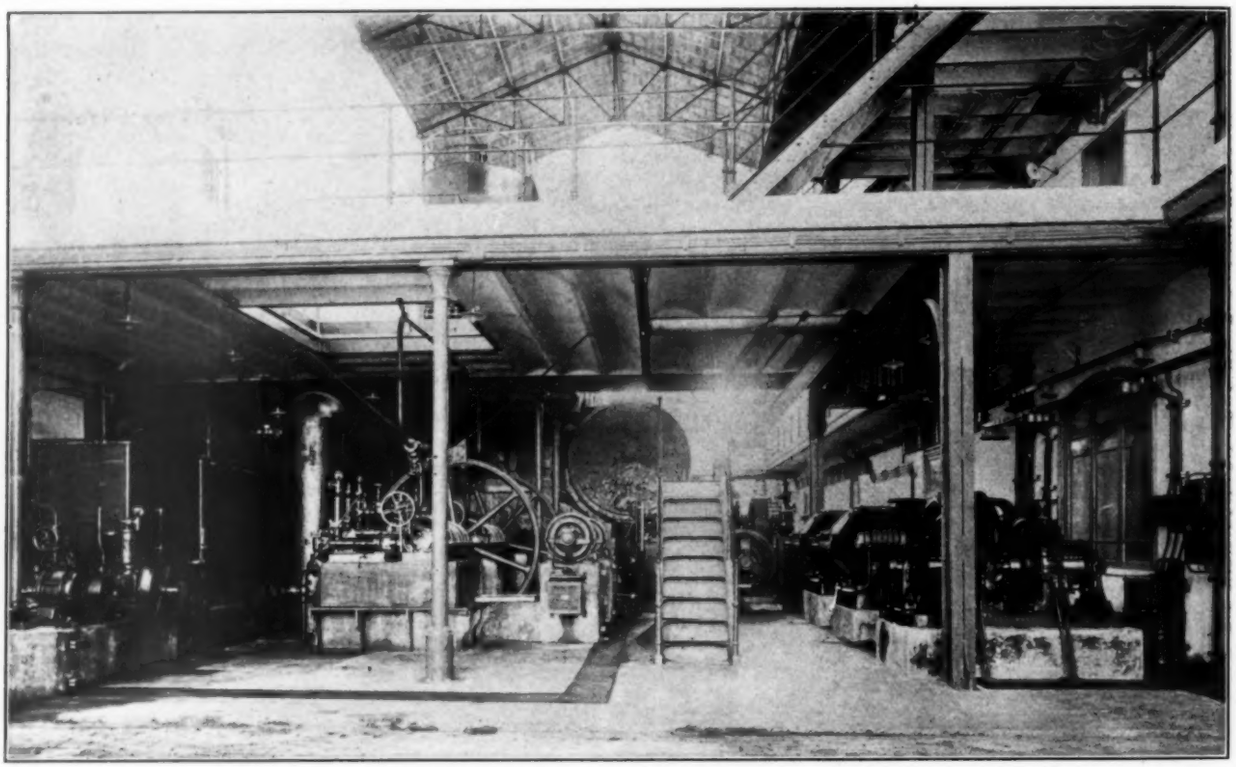
The boiler room contains twelve boilers of the vertical water-tube type, each unit having 320 square metres heating surface and producing at the normal working from 10,000 to 12,000 pounds of steam per hour at a pressure of 13.5 atmospheres. This output can

be easily increased by forced firing, keeping at the same time within good economical conditions. With each of the boilers there is used a superheater having a heating surface of sixty-seven metres and these allow of carrying the temperature of the steam to 300 degrees centigrade. The twelve boilers are disposed in two parallel rows on each side of the middle passage, and each of the rows has three groups of two boilers with which are used a single smoke flue and a common chimney. With each boiler is mounted an economizer of ninety-six tubes placed directly behind it so that each group consisting of boiler and economizer forms a single unit. These economizers are provided with special cleaning devices consisting of scrapers for the tubes, which are worked in common by belting from a main shaft passing along the boiler room, using one such shaft for each row of boilers. Each of the shafts is driven by an eight-horsepower electric motor.

A well-designed automatic stoking system is used with the furnaces, as will be observed. The grate surface for each boiler is 7.25 square metres. The furnaces are designed to burn in usual practice a combustible containing about fifteen per cent of volatile matter, but they can be used with any of the ordinary kinds of coal, as well as for lignite and for any sizes. For each row of boilers the firing mechanism is worked by belt from a main shaft which runs underneath the flooring. A three-phase motor of fifteen horsepower working at 880 revolutions per minute operates the shafting by means of reduction gears. It can also be driven, if need be, by a second motor for which direct current is furnished by a storage battery, so that means are provided for working the stokers when starting up, even if the busbars are not supplied with alternating current. Bins of reinforced concrete are mounted above the boilers and are designed to take 270 tons of coal, these being placed in the axis of the boiler room. In the same axis, but outside the room is a hopper for receiving the ash, also built of reinforced concrete and closed at the bottom by a strap. Each corresponds to two boilers lying opposite each other and the coal is fed down by means of a set of gates. The coal is brought to the bins by a bucket conveyor which transports thirty-five tons of coal per hour. In the coal yard is an electric crane with dredge bucket for taking up the coal and feeding it to the conveyor. This latter forms an endless chain and passes above the bins and the ash hopper, then descending along this latter and passing in the basement, finally reaching the coal yard. The same conveyor serves to carry off the ashes and clinkers from the furnaces, and these are filled into it by hand. The conveyor then takes them to the ash hopper whence they are run out into carts from a lower trap.

Owing to the situation of the plant on the Tiber and also near the railroad line, a coal supply can be easily obtained by a branch connection with the railroad or from coal barges on the river. Special devices are use in the boiler room for registering the pressure in the smoke flue and for obtaining the percentage of carbon dioxide contained in the products of combustion.

The San Paolo station is designed to be thrown into service very quickly as a reserve or substitute for the hydraulic plants, so as to reduce to a minimum the stops which might occur from an accident in the hydraulic system, and it is therefore necessary that the boilers should be put under pressure very rapidly. To this end there



CONDENSERS AND MOTOR-DRIVEN AUXILIARIES IN BASEMENT OF SAN PAOLA PLANT.

is mounted upon each of the smoke flues and near the corresponding chimney a motor-driven fan which causes a draft in the flues. Each of the two fans is driven direct by a continuous-current motor.

Condenser water supplies the boilers, and the losses are made up by reservoirs placed on the premises, using sand filters delivering twenty-five cubic metres per hour. The condenser water is collected in two tanks placed in the basement and the feed of the extra water into the same tanks from the outside is automatically regulated by a float device.

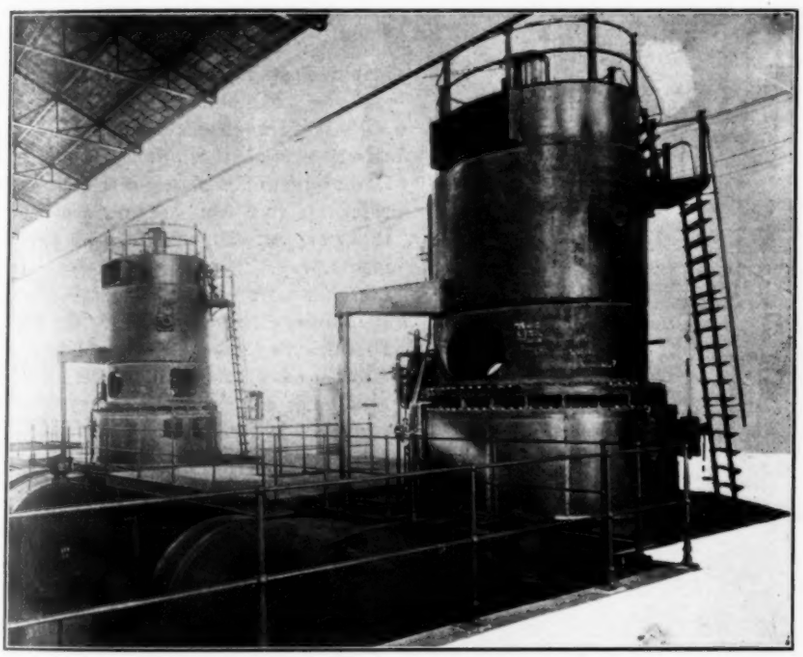
The boilers can be fed by two systems which are quite independent, the first of these being made up by two feed pumps of the rotary type, each delivering forty cubic metres of water per hour at a pressure of fifteen atmospheres. Each pump is direct driven by a three-phase motor of thirty-five horsepower, running at 2,400 revolutions per minute. The second feeding system is designed to serve as a standby in case of accident to the pumps and consists of a separate injector with each boiler and possessing its own steam and water piping. A common feed piping serves for all the injectors, and it is supplied either from the reservoirs in the basement or, if need be, from the outside water tanks. A set of feed pumps supplies the common piping for the injectors.

The steam piping consists of a main steam pipe which serves for all the boilers and it is joined by branch pipes with the two steam turbines in the dynamo room. All the steam piping is carefully covered so as to keep the heat loss to a minimum and to prevent condensation of the steam.

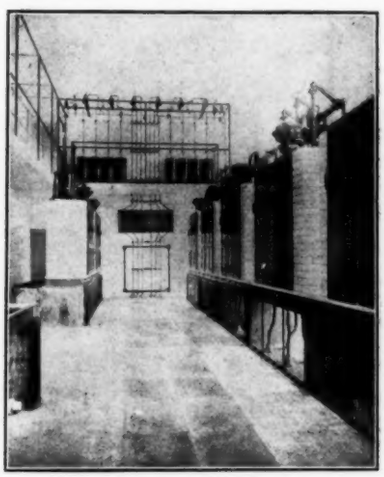
One of the illustrations herewith shows a view in the dynamo room. Here are mounted two main turbo-generator groups. The turbines are of the Curtis type and these, as well as the electrical part of the equipment, were built in the Thomson-Houston Company's Paris factories. Each of the present turbine sets is rated at 3,000 kilowatts. The turbine is designed to operate with superheated steam at 275 degrees centigrade and twelve atmospheres pressure, and it runs at the standard rate of 880 revolutions per minute. The alternator delivers three-phase current at 8,500 volts between phases and a frequency of forty-four cycles. This voltage can be varied by ten per cent on each side of normal when required, and the speed of the turbine can also be regulated by 3.5 per cent above and below the normal. The generating sets can readily support an overload of twenty per cent for a considerable time, so that they often furnish as high as 3,500 kilowatts on the power line per unit.

The alternators are of the revolving field type and the exciting current is supplied from direct-current generators at 125 volts. Single-phase or three-phase current can be delivered by the alternators according to the requirements. The stators of these machines are wound on the star principle, using machine-wound coils which are laid in open slots in the fixed armature core.

In normal working, the turbines are run condensing, but at the same time they are provided with a special automatic valve on the exhaust so that if need be they can be run on free exhaust. The appearance of the condenser room in the basement will be observed in an accompanying illustration. A number of motor-driven pumps are mounted here, one of these being a turbine pump which delivers 1,500 cubic metres of water per hour. It is direct driven by a three-phase motor of seventy-five horsepower, running at 440 revolutions per minute. An air pump of the compound type operated at 150 revolutions per minute is coupled to a three-phase motor of thirty-five horsepower.



TURBO-GENERATOR AND SUB-BASE CONDENSERS IN SAN PAOLA PLANT, ROME, ITALY.



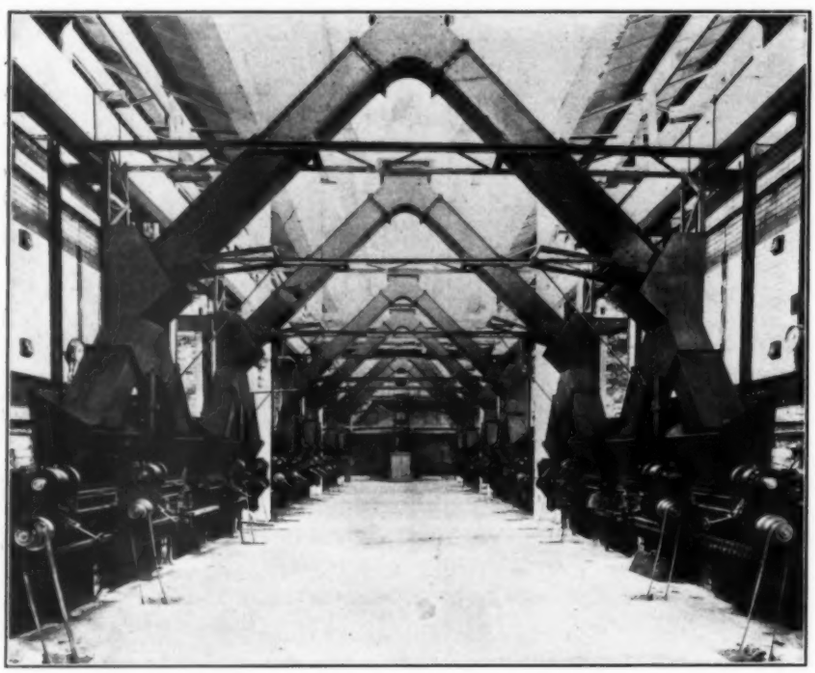
OIL SWITCHES AND LIGHTNING ARRESTERS.

Outside of the main turbine groups and their accessories which have just been mentioned, the station comprises other apparatus for the auxiliary services, which are classed in three categories, exciting current and supply of auxiliary motors, oiling of the turbines and water supply from the river.

For the exciting current for the alternators there are used two motor-generator groups, each of which is sufficent for feeding both alternators. Each group consists of a three-phase motor of the squirrel cage type, runnings at 860 revolutions per minute,

direct connected to a direct-current generator of ninety kilowatts and 125 volts. When required, the two generators can be coupled in parallel with a small storage battery of sixty-six cells of 440 ampere-hours capacity (on one hour discharge) which serves as a standby and assumes the supply of exciting current. A small petrol-motor-driven generator serves for charging the storage battery even when the steam plant is entirely stopped.

Three single-phase transformers of the oil type, each unit having 250 kilowatts output, lower the voltage of the circuit taken from the 8,500 volt bars to 220 volts for the supply of the different light and power lines for use in the station. Lubrication of the turbines is carried out by oil piping, this being fed by two motor-driven pumps each delivering eighty litres per minute. Each of the motors is belt-driven by a fifteen horsepower, three-phase motor.



BOILER ROOM IN SAN PAOLA PLANT.

On account of the rapid freshets of the Tiber, the station is built at a high level, so that the normal water level is about twenty-five feet below. A pumping station was therefore needed on the bank of the stream so as to raise the water to the plant, where it is received in large reservoirs. Laid out for four pump units, the station now has two of these installed, and they have an output of 1,600 cubic metres of water per hour, being operated by three-phase motors with vertical shaft, of seventy-five horsepower each. These motors receive current at 220 volts by special load—covered cables leading from the main plant.

On the main station premises there is another pumping plant for elevating the water from the above reservoirs into tanks mounted at a higher level. Two turbine pumps for this purpose are driven by ten-horsepower motors of the squirrel-cage type.

One of the illustrations shows the appearance of the main switchboard. The main plan calls for the use of a double set of three-phase busbars at 8,500 volts, allowing for the supply of two separate circuits. These bars are disposed in U-form and are composed of six bare copper conductors carried on porcelain insulators within masonry partitions which separate the different phases. Upon one branch of the U are connected the two alternators of the plant, leaving space for two new groups, while upon the other branch are coupled the four underground feeders as well, as a switch for connecting the two sets of bars and also a line for the station transformers.

The main switchboard consists of three parts, a board for highly-tension alternating current, a board for direct current excitation at 125 volts, and a third board for low-tension alternating current. The panels for direct current and for high-tension current are mounted in an upper gallery, as will be observed, while the low-tension board is placed in an annex room. The main board which is shown here consists of ten vertical panels on the rear side and facing the dynamo room, and a set of five remote control panels of desk form lying opposite. This latter board is used for the 3,000 kilowatt machines and for coupling the busbars, while the vertical panels are used for the outgoing feeders, and also for the auxiliary services of the station. From the switchboard are operated the 8,500-volt oil switches which are located in another room. One of the accompanying views shows the disposition of these switches. Five of the straight panels serve for the direct current circuits of the plant.

Rapid Forming of Positive Lead Accumulator Sheets.

M. Mitrofanoff has been studying the question as to the quick formation of lead accumulator plates, especially with reference to the use of nitric acid for that purpose. The results of his experiments, says *The Electrical Engineer*, are that no advantage is gained with the strong currents necessary for rapid charging in the case of flat plates, but that the case is somewhat different with rolled up or corrugated plates. Here, probably on account of the character of the surface, durable coatings can be obtained, so long, however, as the concentration of the acid used is not too great. Further experiment is badly wanted, but even what Mitrofanoff has done so far is exciting considerable attention in German electrical circles. When we consider that for self-propelled electric vehicles we have lead accumulators, and them only, and see no prospect of anything less dead-weight being invented, the question of making the best use of the lead we must carry is of the highest importance.

Magnetic Moment of Chrome-Steel Magnets.

At a meeting of the Royal Dublin Society on February 22 last, Prof. W. Brown read a paper on chrome-steel magnets, in which he stated that of eight steels tested containing from 1.75 to 9.22 per cent of chromium, the highest magnetic moment for a given weight was afforded by a steel containing about 2.5 per cent of chromium.

Chicago Electric Club.

"Recent Developments in Storage Battery Application" was the subject of an interesting and instructive address delivered by Taliaferro Milton, district engineer for the Electric Storage Battery Company, at the regular midday meeting of the Chicago Electric Club, on Wednesday, April 6.

Mr. Milton, by way of introducing the subject made a few general remarks regarding the use of storage batteries and the question of their use by many of the illuminating companies, pointing out that in Chicago the Commonwealth Edison Company has installed about 27,000 kilowatts in storage batteries, and in New York the Edison Illuminating Company over 57,000 kilowatts.

However, the most recent application of storage batteries has been for regulating fluctuations in alternating-current loads and Mr. Milton mentioned several installations of this character.

The first equipment mentioned was installed by the East St. Louis and Suburban Railway Company in its power station at St. Louis. At the time of the installation there was in use at this station a storage battery with the shunt regulating booster and carbon regulator for regulating the fluctuations of the direct-current load. The battery consisted of 300 cells of 12,000 amperes capacity, and was of sufficient size to contain elements of 24,000 amperes capacity momentarily. The equipment of the plant also included two 800-kilowatt, three-phase, engine-driven turbo alternators supplying 13,000 volts to a number of rotary converters, and also a 300-kilowatt rotary converter which was used to supply current to the 600-volt railway bus.

The battery, with a booster in series, was connected directly to the direct-current terminals of the rotary, the rotary being operated as a shunt-wound machine self-excited, with a series winding cut-out. The current transformers were connected in the alternating-current leads of the alternater and the secondaries of these current transformers were connected in parallel to the solenoid of the carbon regulator, the carbon regulator, in turn, controlling the field of the booster, in the same manner as used in direct-current work.

The booster voltage was therefore made to vary with the variations in current in the alternating-current mains, and the battery, through the converter, was enabled to take the fluctuations from the alternating-current system.

Another interesting installation mentioned by Mr. Milton was in the power plant of the Carnegie Steel Company at Youngstown, Ohio, in which the watt-solenoid method of control was used to control the field of an alternating-current booster.

The battery in this case was connected directly across the direct-current terminals of a rotary converter without any booster in the battery circuit on the same shaft. With the rotary was placed a small alternating-current booster which consisted of a three-phase generator with three separate windings. Each of these windings was connected in series between the alternating-current busses and one of the slip rings on the rotary.

Other similar installations at Spokane, Wash., and at Gary, Ind., were briefly described, and the features of each installation pointed out.

The speaker then described a new apparatus which has recently been placed on the market known as the "Average Load Adjuster," which automatically regulates the fluctuations of a load by means of a motor, the armature of which is geared to the adjusting wheel of the carbon regulator. The field of this motor is excited by booster voltage.

In accordance with the recent practice of illuminating companies, using storage batteries only as stand-by batteries in cases of emergency, Mr. Milton stated that the thin pasted plate as used for automobile cells had been successfully used for this class of work. He said that batteries of this construction are of double the capacity of the older types, and the first cost is only about thirty-five per cent more.

In conclusion, the speaker described a new high capacity end cell switch being placed on the market, which has a capacity of 5,000 amperes continuously, 10,000 amperes for twenty minutes, and 20,000 amperes momentarily. The general design of this switch involves such modifications of the modern cell switch as are necessary to provide for the heavy current to be handled.

H. Almert, of H. M. Byllesby & Company, asked the speaker to what extent the storage battery could be used for regulating fluctuations in an alternating current load in small stations. Mr. Milton said that it depended entirely upon the amount of money the company could invest in such an equipment, as a net saving of twenty per cent could be made on the investment, but many small companies are not able to make an investment even with this saving in view.

C. A. S. Howlett, former president of the Club, was present and congratulated the Club on its progress and also complimented Mr. Milton on his excellent talk.

Foreign Trade Opportunity.

An American consul in Australasia reports that a company has been organized in his district for the development of certain local water powers to be used in metallurgical works. It is estimated that the cost of the water power plant will be $729,975. The company also expects to sell to a neighboring municipality power for use in lighting, street-car service, etc., and as fast as business warrants additional installations of machinery and equipment will be made. American manufacturers of electrial, hydraulic and metallurgical machinery who may desire to secure business orders in connection with this development can obtain the name of the company, together with further details embodied in a confidential circular, upon application to the Bureau of Manufactures for file No. 4697. The consul states that there will be time for American manufacturers to communicate with this company, as details of construction will probably not be arranged before six months at least or until the financing of the construction has been arranged for in London.

Electric Railway for Quito.

The municipality of Quito, Ecuador, has granted a franchise to E. H. Norton Company to build electric car lines for passengers and freight in the capital of the republic. All cars, machinery, and construction materials necessary for the equipment of the tramways may be brought into the country free of duty. The construction of the lines must be begun within six months from the date of the contract and terminated before the expiration of three years from said date. The municipality is to receive five per cent of the net income of the car lines at the end of each year, during the first ten years, and ten per cent for the rest of the time.

A NEW USE FOR ELECTROLYTIC CHLORINE.

BY J. B. C. KERSHAW.

One of the special problems connected with the electrolysis of common salt, is to find a remunerative use for the chlorine produced. Double the amount of chlorine is obtained per ton of salt decomposed as compared with the older Le Blanc process of alkali manufacture, and this increased production of chlorine has led to an excessive output of bleaching powder in Europe, and to a marked fall in the value of this product. For some years past the companies operating electrolytic alkali processes have been on the lookout for new uses for the chlorine gas liberated in the anode compartments of their cells, and many works have taken up the manufacture of carbon tetrachloride, pure hydrochloric acid, and of the chlorine salts of tin, in perference to that of the older staple product, namely chloride of lime.

In a recent issue of *Chemiker Zeitung*, particulars are given however, of some new chlorine compounds which are somewhat similar in properties to carbon tetrachloride and which may prove of great use in the oil and fat industries. These compounds possess almost ideal properties as solvents. They are extremely energetic in their action upon oils, fats and resins, and yet they have little or no action upon the substances dissolved, or upon the iron and lead vessels in which they are contained. The compounds are chlorine derivatives of ethane and ethylene, and are produced by acting upon acetylene with dry chlorine.

The parent substance of the series of derivatives is tetrachlor ethane—represented by the chemical formula—$C_2 H_2 Cl_4$—a liquid of which the boiling point is 147 degrees centigrade, and the specific gravity 1.60. The three ethylene compounds are represented by the formula given below, their boiling points and densities being lower than those of the ethane series.

Dichlor ethylene, $C_2H_2Cl_2$; boiling point, 55° C.; specific gravity, 1.25.

Trichlor ethylene, C_2HCl_3; boiling point, 88° C.; specific gravity, 1.47.

Perchlor ethylene, CCl_4; boiling point, 121° C.; specific gravity, 1.62.

These three compounds are, even in presence of moisture, practically without any action upon iron, copper, lead or zinc; and are also without any chemical action upon oils or fats. For industrial use the absence of any action upon iron is most important.

The amount of hydrochloric acid liberated, and found either free or combined in the solution, at the end of forty-eight hours boiling of a mixture containing 250 grams of the solvent and 100 grams of water, in an iron vessel having two square decimeters of exposed surface was as follows: Using solvent of dichlor ethylene, 0.01 gramme; trichlor ethylene, 0.007 gramme; perchlor ethylene, 0.036 gramme.

One may therefore employ these new chlorine compounds as solvents, for oils, fats and resins in iron vessels, with much less risk of contamination by the iron than the more usually employed carbon tetrachloride. It is expected that their use will have a considerable vogue in the oil, fat, and resin industries.

Radical Railroad Regulation and Its Effect on Business.

T. A. Griffin, president of the Griffin Wheel Company, of Chicago, is one of the prominent manufacturers of car wheels and maintains a large interest in a string of foundries located in many parts of the country. Mr. Griffin has prepared some interesting data on the subject of radical railroad regulation and its effect on business. He voices a strong protest against the injury that he considers is being worked to business in general because of the timidity of the corporations in making decisions to re-equip their properties because of the apprehension that radical legislation will discount the benefits which would ordinarily accrue from these betterments. He thinks that every business man should be interested in his appeal for aid in calling a halt on radical railroad regulation, because it affects business in general even more than it does the railroads.

The Telephone in Bucket Shops.

As a result of reports from Washington, that the Western Union Telegraph Company was paid a large sum for furnishing service to certain bucket shops, Belvidere Brooks, president of the American Telephone and Telegraph Company, stated that it was impossible to discriminate in giving telephone or telegraph service. Mr. Brooks said in part:

"Telegraph companies are required to render service to the public without discrimination, and cannot and should not be permitted to inquire into the character of the message or its purpose. It is utterly impracticable for a telegraph company to investigate the business affairs of persons dealing with it, and it is under no duty to make such investigation. In most of the states this right of the public to have its business transmitted is provided for by severe statutory penalty. Neither the courts nor the public would for an instant permit a telegraph company to act as censor."

Largest South American Newspaper Installs Wireless Apparatus.

One of the largest and most influential newspapers in the world, *La Prensa*, of Buenos Aires, has arranged to install a wireless service in its main office. This interesting daily newspaper has one of the finest buildings and one of the most extensive and completely equipped printing establishments in the world, and its daily issue runs into hundreds of thousands of copies. The cable service of *La Prensa* is very comprehensive and covers in a very thorough and efficient manner every country and news center of the globe.

The first use that *La Prensa* will make of wireless telegraphy will be the transmission of news between its office and the exposition grounds during the celebration of the hundredth anniversary of the establishment of the Argentine Republic. The exposition opens on May 25, 1910.

The installation of this service by the largest daily of the metropolis of South America makes an epoch in the newspaper world of the South American continent, and affords a long-needed complement in Buenos Aires to the vast cable and telegraphic systems of the southern part of the Western Hemisphere.

Laundry Exhibition in England.

At the exhibition of laundry machinery, etc., which was held in the Royal Agricultural Hall, London, England, from April 2 to April 9 last, a fine show of electric drive and electric heating systems for laundry work was shown, and a great boost was given to the application of electricity in this important industry.

The Electric Furnace in the Iron and Steel Industry.

At a recent meeting of the Sheffield (Eng.) Society of Engineers and Metallurgists, Gerald Hooghwinkel read a paper on "The Place of the Electric Furnace in the Iron and Steel Industry." In the following abstract, which is taken from the Engineering Supplement of the London (Eng.) *Times* of March 16 last, the English money values have been turned into approximate American figures.

The lecturer predicted that in the near future nearly all the steel required would be of special qualities containing one or more of the rarer metals. Nearly all these steels had been manufactured in the electric furnace in various countries, and before long no steelworks would be complete without electric furnaces to supply at reasonable prices the ever-growing demand for special steels made to definite and stringent specifications. By far the greatest demand, however, would arise when once the railway authorities had settled upon a new rail for main lines, the present rails being entirely unsuitable, both chemically and physically, to stand the great strams to which they were submitted during a reasonable period. A beginning in this direction was being made by the German State Railway authorities, who had issued a specification for electric steel rails, specifying higher figures for the physical tests and resistance to wear than was usual for the ordinary basic rails—viz., a tensile strength of 99,000 pounds per square inch, against 85,000 pounds per square inch. They also required a guaranteed life of ten years for track rails. The cost of the electric power entered into the calculations only to a small degree, and was only a small fraction of the total cost of production, about three per cent to eight per cent for hot and cold charges respectvely. This point was often misunderstood by steel manufacturers. Even with a town supply at a price of between one cent and two cents per kilowatt-hour the production of electric steel was a proposition of no uncertain merit. But in the waste gases from blast furnaces and coke ovens a cheap supply was available for operations on a large scale, and it would be found that this was quite the most economical and profitable way of using these waste gases, the other power requirements at the steel works being satisfied from some other source of supply. These electric furnaces would supply an excellent load on account of their high load factor, which was fifty per cent and seventy-five per cent for hot and cold charges respectively. If operations could be so arranged as not to coincide with the peak loads of the supply stations very low prices could be charged. This was actually being done at the Niagara Falls and other power centers in the United States. The next general use to which the electric furnace would be put was the production of steel castings both for high-grade and medium-grade products. It would replace the crucible method, to which it was much superior, owing to the absence of the expensive and short-lived crucible with its inherent disadvantages of introducing impurities into the steel. In addition, the high temperature of the cast could be utilized in manufacturing complicated parts. The pure Lancashire and Swedish iron formerly used in the crucible furnace for this class of work cost $50 per ton, and the casting about $75 to $100 per ton. The cost of production of these steel castings in a one-ton Stassano furnace at the Bonn File Works amounted to $45 per ton, including all capital charges. This difference was cause by the cheaper materials (scrap at $16.75 per ton), while the total cost of current, upkeep of furnace electrodes, etc., together amounted to $16, less than the cost of crucibles, coke, wages, etc., required by the crucible furnace. In dealing with the production of special steels in the electric furnace, the lecturer mentioned a case where a certain quality of steel was being made in the United States for $90 a ton, for which the selling price in Sheffield was $1,000 per ton. He recommended the electric furnace for small as well as large works.

Disturbing and Beneficial Influences in the Transmission of Electric Waves.

This article is a contribution to the proofs that the ether does not always have the same conductivity for electric waves, but differs at various times of the day, and a number of instances are cited in which messages sent out by stations having a reach of only a few hundred kilometers were clearly received at distances of over a thousand kilometers. The stronger the sunshine the more the conductivity of the ether for electrical vibrations decrease. If, therefore, electrical disturbances manifest themselves most strongly during the night, it is because of the greater conductivity of the ether which transmits the vibrations of distant atmospheric discharges, that would not be observed during the daytime. For this reason wireless telegrams are also received at correspondingly greater distances during the night. This fact leads to the view that one cannot speak of a maximum transmitting area of a wireless station, for the same station that reaches to great distances at fifty degrees northern latitude may eventually cause astonishment by its much smaller capacity in the tropics, precisely on account of the larger area of sunshine. To determine how great this difference is will require further investigations. The collection of statistical material bearing on this subject would be desirable, so that on the basis of the same a radio-topographical map might be prepared, which would be of great value in wireless communication between vessels.—*Translated and Abstracted from Elektrotechnische Zeitschrift (Berlin), February 3.*

Raise Rates for Soft Coal.

The possibility of an increase in the price of soft coal confronts producers through action of the railroads serving the Illinois and Indiana fields, says *Chicago Commerce*. It is proposed by the carriers to increase the cost of coal transportation from eight to twelve cents throughout the entire territory of these states. This increase is protested both by the mine operators and consumers. Already two conferences have been held between the railroads, operators and representatives of the Illinois Manufacturers' Association and The Chicago Association of Commerce. It is the contention of the protestants that to increase rates encourages still further invasion of the home market by shippers from the Ohio, Pennsylvania and West Virginia fields, with consequent loss of business and efficiency by mines nearer home, and which for this reason, if for no other, should receive the support both of carrier and consumer.

Uniform Telephone Numbers for Western Union.

As a step toward uniformity the Western Union's telephone number in every city will be 4321.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

Winnipeg Municipal Power Plant.

From a description by Consul-General Jones of the constructions under way which are to utilize the hydraulic resources of the Winnipeg River the following points are taken:

The city of Winnipeg decided in 1905 to undertake the erection of a plant for generating electrical energy to supply its needs upon the expiration of the franchise law now held by the Winnipeg Electric Street Railway Company. A careful examination was at once made of the hydraulic resources of the Winnipeg River, and the report of the engineers having been followed by the voting of $3,250,000, plans were begun in 1906. Some delays were experienced, during which only preliminary work was prosecuted, but early in 1909 contracts were awarded and their vigorous execution begun.

Since the winter began, the closing of the river by means of a rock fill has been prosecuted, and already the upper waters have been raised several feet. The natural elevation of the upper river will be increased by the permanent work by thirteen to fifteen feet, giving to the total waterfall developed a head of forty-five feet net. During the winter also work on the power house has proceeded under a huge frame shed; energetic progress has been made in the manufacture of the equipment, and the transmission lines were got fairly under way, advantage having been taken of the frozen condition of swamps through which the right of way leads.

The site of the generating station, which has a capacity of 60,000 horsepower, is on the Winnipeg River about ninety-five miles by rail or seventy-five miles by transmission line northeast of Winnipeg. The location is ideal. At a point where the Winnipeg River, a sturdy stream 3,000 yards wide, is narrowed by a spur of its eastern bank to a channel one-fourth mile wide, the river has been dammed by a wing wall of concrete and a rock fill. The water thus checked above the spur of land is released through a canal cut across this spur. At the end of this canal is the power house.

The prominent features in the design of this power house are that it is very compact and of the latest plan; it will be built entirely of re-enforced concrete; it will be fitted with wheel pits instead of steel flumes around the turbines, so that in a sudden stopping of the turbine gates the water instead of endangering the penstock will merely rise in the pit.

The undertaking when completed will consist of the following: (1) A 60,000-horsepower generating station operating under forty-five to forty-six feet of hydraulic head. Important features are: (a) There is a large lake adjacent to the head gates, with consequent favorable operating conditions; (b) there are rock foundations for all constructions; (c) there is a difference of hydraulic level which will be practically constant; and (d) the water is free from salt or other objectionable matter. (2) A seventy-seven-mile transmission, consisting of four three-phase circuits carried on two series of double-circuit steel towers with concrete footings. (3) A terminal station at the city at which the pressure of the current transmitted will be reduced to 11,000 volts. (4) An underground cable distribution to all substations where the voltage will be reduced to 2,200 volts. (5) A secondary underground and overhead distribution to customers.

On the completion of the plant electric power will be offered to manufacturers at attractive prices, and it is expected that there will be a considerable demand for it, as there are in operation in Winnipeg steam plants the aggregate demand of which approximates 15,000 horsepower, and the rapid growth of the city, as well as the development of the vast country to the west, all tend toward a rapid increase in the application of electricity. On a fair estimate of the possible market power from the civic plant, the prices to small users will be about three to seven cents per kilowatt—a reduction of about one-third on the present prices.

Turbine-Driven Sets for Irish Municipality.

The Belfast Corporation has decided to extend its street-railway generating plant by the addition of a 1,500-kilowatt Willans impulse "disk-and-drum" type turbine, coupled to a direct-current dynamo. This decison, says the *Engineer and Iron Trades Advertiser* (Glasgow, Scot.), is interesting in view of the strong opposition brought forward against the adoption of direct-current turbines when the previous contracts were settled during February, 1907. On that occasion two units of 1,000 kilowatts were required, and the feeling expressed in many quarters at the time was that direct-current turbo-generators were not sufficiently reliable to meet the requirements of a street-railway load. Not till the matter had twice been referred back from the Tramway and Electric Lighting Committee did the Belfast Council finally decide to install two 1,000-kilowatt direct-current Willans turbine units. These sets have now been in daily operation for some two years, and it is understood that the performance of the dynamos—which were considered the doubtful factor—compares favorably with the best results obtainable with dynamos running at more moderate speeds. Accordingly, Mr. Bloxham, the Belfast engineer, has now recommended his Council to lay down a further unit of 1,500-kilowatt capacity, and as it is intended to obtain this output from one dynamo, and not from two dynamos arranged in tandem, as has previously been the case when dealing with such an output as this. The present unit will be the largest single direct-current set installed in the British Isles, being somewhat larger than the two 1,200-kilowatt units which its makers, Willans & Robinson, Ltd., have in hand for

the British Admiralty for the Devonport (Eng.) Dockyard.

An Unusual Power Plant.

The power plant of the Virginia Electric Power & Water Company, of Virginia, Minn., is unusual in a number of respects, says the *Engineering Record*. It is without a boiler house and steam is purchased from a neighboring saw mill, the supply varying in pressure. When the problem of increasing the capacity of the station came up for consideration recently, and some flexible arrangement of units was sought so as to obtain high efficiency, it was found that with the two simple Corliss engines, one driving a 200-kilowatt belted generator and the other a direct-connected 300-kilowatt generator, only a comparatively small economy could be attained by operating condensing. The fluctuations in the steam pressure made it undesirable to use a high-pressure turbine. The company also has a pumping plant which had to be considered in working out the most economical arrangement of apparatus, and a high-pressure turbine would offer no advantage in connection with the pumps. Under the circumstances it was finally determined to put in an Allis-Chalmers low-pressure turbine to utilize the exhaust steam from the Corliss engines and steam pumps. This turbine has now been in service about two months.

It has been found that when the steam pressure supplied by the saw mill drops so low that the Corliss engines will not by themselves carry the full load and are running at a long stroke of steam, the turbine consequently gets more steam and carries more than its normal share of the load; the turbine runs in parallel with the other units. Theoretically there is assumed to be about one and a half pounds back-pressure on the exhaust of the Corliss engines, but actually there is sometimes a vacuum of ten inches at their exhaust. Little difficulty is found in maintaining a twenty-eight-inch vacuum on the turbine.

In response to a recent inquiry as to the operation of this combined plant, O. H. Griggs, vice-president and general manager of the company, made the following statement: "So far, we have been able to make no actual test of the exact work the turbine does, as our wattmeters are not yet connected and our other instruments are disconnected because we are changing our switchboards. We believe, however, that when we are generating 300 kilowatts with the Corliss engines that our turbine, by utilizing their waste steam, will deliver at least 275 to 280 kilowatts, this being the net gain in efficiency. In the day time we find that by utilizing the exhaust from the pumps in the turbine we are able to carry our day load. This is also a net gain in efficiency."

Physical Properties of Switch and Transformer Oils.

The physical properties of switch and transformer oils have formed the subject of an interesting paper considered at the Manchester Section of the Institution of Electrical Engineers. W. Pollard Digby and D. B. Mellis, the authors, gave in the main the fruit of investigations extending over many months, which were taken for the sole purpose of acquiring knowledge as to the electrical properties of these oils in general, and the respective merits of well-known brands in common use. In other branches of engineering science the study of materials which had commenced with the examination of physical properties before use, had tended towards examination of their properties and deterioration during use. Oil for oil-break switches and transformers had not received either the preliminary attention in the laboratory, or the investigation in use, that had been given to, say, transformer iron or to steel rails. Much trouble had probably arisen as a result of casual rather than scientific selection, followed by carelessness and neglect. The authors put forward their account of their investigations of some of the physical and chemical changes occurring through use, with the object of urging the systematic examination of oil before use, as well as suggesting standardized methods of testing. While they considered that even the makers of the best oils failed every day to maintain a standard quality of excellence, they also considered that the electrical engineer was equally to blame for not having insisted on uniformity of quality. No single brand of oil was referred to by its trade name in the paper, all samples being distinguished by initial letters and numbers. Just as the presence of an impurity in a metal increased its specific resistance, so the presence of any soluble impurity in oil must tend to decrease its value as a medium offering a resistance to the flow of electric current. The general conclusions deduced by the authors pointed to the fact that the variation of specific resistance with temperature depends upon the grade of the oil, coupled with the suggestion that specific resistance measurements may be used to ascertain (by comparison of a series of heating and cooling curves, with a progressive increase in temperature), the point at which this obscure point of probable molecular regrouping of the hydro-carbon constituents takes place. This matter, they said, while only perhaps of academic interest in regard to the classes of oils forming the purpose of their paper, might prove of value in the selection of oils for use on reciprocating engines using superheated steam.

A. H. B.

Thin Steel Belts.

In a paper entitled "The Transmission of Power by Belts," read by Reginald Krall, before the Junior Institution of Engineers (London, Eng.) on March 14 last, the author described various kinds of belt-drives.

The most interesting part of Mr. Krall's paper, says *Engineering*, related to the use, in Germany and Belgium, of thin steel belts for driving purposes. These belts are from 0.2 to 0.9 millimetre in thickness, and from twenty-two to 200 millimetres in width. Thus for a 200-horsepower drive one belt, 150 millimetres wide by 0.6 millimeter thick, is used, while for a 450-horsepower drive two belts, each 150 millimetres wide by 0.7 millimetre thick, are employed, the belts being placed side by side on the pulley.

The trouble met with in the use of these belts appears to have been the difficulty of obtaining a perfectly homogeneous steel. This, however, is being remedied, and the steel used is specially manufactured, and is of a very high temper. The joint was at first also a difficulty. Originally the belt was soldered in place on the pulleys, but it has been found better to do the necessary soldering at the factory by trained men, a kind of locking joint being fixed on the ends of the belt, leaving only a few screws to be put in by the user when the belt is placed in position. The solder used has a low melting-point (not exceeding 200 de-

grees centigrade), so as not to run off the temper of the belt. Many methods of making the joint by means of brazing appear to have been tried, but without much success.

The exact length of the belt is determined by a special apparatus, consisting of a light steel tape, which is placed round the pulleys and subjected to a predetermined tension. This tape is then cut to the exact length, and is used as a measure for the steel belt. These steel bands are said to run well on bare pulleys, but after a time the surface of the pulley is found to become polished, and it is therefore better to place on it a cork covering, glued to canvas, which is, in turn cemented to the pulley.

In a properly-designed drive of this kind there is said to be practically no slip. A table showing the results of some tests was included in the paper. Very high speeds, up to 10,000 feet per minute, can be adopted with these steel belts, and the belts do not appear to wear. It is also claimed that very short drives may be used.

Economizing Oil.

In an article entitled "The Steptoe Smelting Plant, Nevada," which appeared in a recent issue of the *Mining World*, Leroy A. Palmer records the methods adopted toward economizing oil in the plant. All waste is cleaned in a centrifugal separator, and the oil filtered and re-used. Bearing oil is piped from a reservoir to the bearings, and thence to six filters, from which it is returned to the reservoir by a Marsh pump. These filters cost the company $21 each, and by their use the cost of engine oil has been reduced to one and one-half cents per horsepower-month and the bearings are continuously drenched in oil. The re-use of cylinder oil is, of course, impractical, but by making a mixture of one-third 600W and two-thirds Capitol, a saving of twenty-five per cent has been effected with eighty degrees of superheat, and the cylinder oil costs maintained at 10.2 cents per horsepower-month.

Lightning Protection for Buildings.

Sir Oliver J. Lodge, principal of Birmingham University, England, who is perhaps the greatest authority on lightning conductors, gave a lecture on this subject at a recent meeting of the Engineering Society at Birmingham. Sir Oliver stated that the problem consisted in finding the best method of dissipating the enormous energy of the flash, but that it was not wise to get rid of the energy too quickly. A thin iron wire is considered the best lightning conductor from the electrical point of view, but it is almost impossible to protect a building from lightning unless it is completely enveloped in a metal cage. It is by no means true that a building is safe when provided with a conductor reaching up to the tallest part of the building.

To Buy up Kansas Light Plants.

The Kansas Gas and Electric Company with a capital of $4,400,000 has been organized at Kansas City, Mo., to buy the gas and electric light plants in a number of Kansas towns. The company has issued $6,000,000 in bonds, of which $1,600,000 have been sold to purchase the plants in Wichita and Pittsburg. Negotiations for the acquisition of other plants are under way.

The General Electric Company is said to be back of the new company. The directors are: H. P. Wright, J. F. Downing, A. C. Jobes, John F. Prescott and F. G. Crowell, of Kansas City; E. L. Copeland, of Topeka; J. O. Davidson, L. O. Ripley and Charles H. Smyth, of Wichita; M. C. Kelley, of Pittsburg, and A. C. Stich, of Independence.

Electric Club of Boston.

Largely due to the efforts of Superintendent C. F. Ames, the officers and employes of the Western Union Telegraph Company of Boston, Mass., have formed the "Electric Club of Boston," the objects of which are similar to those of the well-known Electric Club of Chicago. The club has at present a membership of seventy, and the following have been elected officers for the ensuing year: President R. W. Hall in charge of the Barclay department; vice-president, W. G. Wetmore, acting chief operator; treasurer, G. W. Tracy, western wire chief; secretary, George Cunningham, eastern wire chief.

Popularizing Electric Cooking and Heating.

With a view to increasing the sale of electricity for electric heating and cooking, the Electricity Committee of Southampton, England, has reduced the charge for current for these purposes to one cent per kilowatt-hour.

Successful Municipal Electric Plants.

In his report to the city of Pasadena, Cal., Councilman Mersereau, chairman of the lighting committee of the city council, claims that the municipal lighting plant is saving Pasadena between $80,000 and $90,000 a year.

Mr. Mersereau's report claims that this saving is on ordinary light bills, while commercial lighting is being furnished at a seven-cent rate; that the municipal company has caused the Edison company to reduce its rate from fifteen to five cents per kilowatt; that the plant represents an outlay of $400,000, but one cent on each $1 of assessed valuation, and has been constructed almost entirely from the sale of municipal bonds. These bonds are being retired as they come due by the earnings of the plant, and interest is met also by the same fund.

Mishawaka to Place Wires Underground.

The city of Mishawaka, Ind., has ordered that all wires in the business section of the city must be placed underground within the next six months. The proposed ordinance will affect all telegraph, telephone and electric-light companies, and will call for the wiring of all buildings from the rear. Poles will be permitted in the alleys and out-of-way-places, but none will be allowed upon the main streets. Conduits will be laid in the alleys and the wires will then be distributed from poles. One conduit with apartments for the various wires will be laid, decreasing the cost to all those who will be affected by the ordinance. The street-car company has signified its willingness to replace its remaining wooden poles with iron ones.

International Housing Congress.

The ninth International Housing Congress, which is to be held at Vienna, Austria, from May 30 to June 1, is the result of a world-wide movement for cheaper and better houses. Among the papers to be read are "Edison Cast Monolithic Houses for Flower Towns," by Thomas A. Edison and T. Commerford Martin; "How Electricity Makes for Improved Housing," by Arthur Williams of the New York Edison Company; and "Workmen's Cities," by William H. Tolman, director of the New York Museum of Safety and Sanitation.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THEORETICAL NOTES ON INTERIOR LIGHTING.—I.

BY W. E. BARROWS.

Much attention is being given to different methods and systems of illuminating interiors with light from artificial sources. In this field there are several systems in vogue, each of which has its advantages and disadvantages as well as its own phases and limitations.

There are two general systems for interior illumination: (1) the indirect-lighting system, in which the light from the source of illumination is projected to a reflecting surface or to the ceiling and walls of the room, from which part of it is reflected as a soft diffused light around the lower part of the room; (2) the direct system, in which the light rays pass directly to the object or surface to be illuminated and may or may not be diffused or diffracted by media surrounding the source.

The choice of a lighting system should be made with regard to the physiologic, aesthetic and economic considerations involved. It is obvious that the weight given these will by no means be constant, no rule will apply to their relative values or importances, since an installation may be under deliberation where the question of economy is paramount, while in another case economy may have no bearing whatsoever. The aesthetic requirements may vary in the same way, but the physiologic elements should always receive the utmost attention in all classes of lighting whether natural or artificial, since it is in this department that harm, annoyance and even permanent injury to the individual may result. Hence this article will treat the subject mainly from the point of view of these latter requirements.

The points to consider in the design of an installation from a physiologic aspect are the amount of light, its quality, and its distribution.

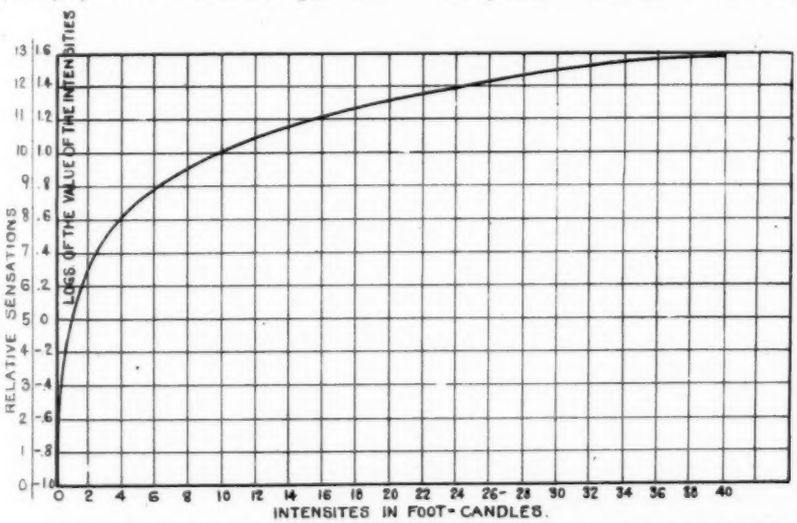

RELATIVE SENSATIONS
LOGS OF THE VALUE OF THE INTENSITIES
INTENSITES IN FOOT-CANDLES.
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40

FIG. 1.—VARIATION OF SENSATION WITH VARIATION OF LUMINOUS INTENSITY.

The amount of light required depends upon the class of service for which it is desired. Too little light upon the subject of observation will lead to fatigue of the optical nerves and eye strain; too much light will produce a glare and the amount of light received by the eye due to reflection will cause annoyance and fatigue, and an excessive amount for a prolonged time may cause defective vision.

Experience has shown that when the eye is working under about normal conditions (possibly between one and two-foot candles), any additional illumination is of relatively small value. These values refer to the light affecting the eye and not to the intensity of illumination on the object of observation. Since this must necessarily be reflected light and as the coefficients of reflection and diffusion of various surfaces and objects vary over a wide range, the calculation which these values suggest, of the amount of light required from the primary source, is not a simple problem. However, it is possible, from general physiologic and physical data, to calculate approximately the desired intensity of the illumination required, if the class of service is known.

As an example, suppose it is desired to ascertain the illumination on the page of a book for reading purposes; assume that page to be 1.25 feet from the eye and that the page is of such material that eighty per cent of the light striking the white part is reflected, then the intensity of light striking the surface should be $1 \times 1.25^2/0.80 = 1.95$ foot-candles, for an intensity of one foot-candle at the eye, or twice this value for an intensity of two foot-candles at the eye, etc.

These values compare closely with those met in practice, although the range of light intensities through which one may read without apparent ill effect is considerable. For instance, it is very easy to read good clear print with an illumination considerably less than one foot-candle after the eye has become accustomed to that intensity, while the intensity of light in the daytime near a large window may be as high as 200 or 300 foot-candles. This may seem incredulous to the reader without further consideration of Fechner's law of vision, which states that the light sensations produced by the optic nerves vary as the logarithm of the values of the stimuli producing those sensations. A truer conception of this law may be obtained by a study of the curve of Fig. 1, which is plotted with intensities in foot-candles as abscissas, and the values of the logar-

ithms of these intensities as ordinates. It will be seen that the same percentage change in intensity will produce the same change in sensation. Thus by increasing the intensity from two to four foot-candles, the same change in sensation will be effected as if the intensity is increased from twenty to forty foot-candles, the percentage increase being the same in both cases. Further study of this law of Fechner's will make it clear that the results obtained by increasing the intensity of illumination above that necessary for the desired effects are of little value. This point will explain the reason for the statements, which are often seen in the technical press, that the effects produced by the use of additional lamps do not warrant the additional expenditure of energy—which goes to show that every man who pretends to handle illumination problems with engineering intelligence should possess a practical knowledge of this fundamental law, and install a number of lamps sufficient only to enable the details of the subjects illuminated to be easily perceived.

The intensities of illumination for various classes of interior lighting vary over a wide range; those that will give general satisfaction for some of the different classes of service may be seen in the following table:

TABLE 1.

Class of service.	Intensity in foot-candles or lumens per square foot.
Art galleries	3.0— 5.0
Assembly rooms	1.0— 2.5
Auditoriums	2.0— 3.0
Ball rooms	2.5— 3.0
Bookkeeping and clerical work	3.0— 5.0
Churches	2.0— 3.0
Desk lighting	3.0— 5.0
Drafting, engraving	5.0—10.0
Factory, complete illumination	4.0— 8.0
Factory, general illumination	1.0— 2.5
Hospital, wards and patients' rooms	1.5— 2.0
Hospital, operating room	8.0—10.0
Hotel, corridors, halls	1.0— 2.5
Hotel dining room	2.0— 3.0
Hotel, guests' rooms	2.0— 3.0
Hotel, parlor	2.0— 2.5
Library, general illumination	1.5— 4.0
Lobbies	1.0— 5.0
Office, consultation and waiting room	2.0— 3.0
Office, general office work	4.0— 5.0
Office, general illumination	1.5— 2.0
Office, private	2.5— 3.0
Reading, good clear print	1.5— 2.0
Reading, newspaper print	2.5— 3.0
Reading, postal service	3.0— 5.0
Reading, dining room	1.0— 2.0
Residence, general illumination	1.0— 1.5
Residence, kitchen	2.0— 4.0
Residence, living room	2.5— 3.0
Residence, sleeping room	1.5— 2.0
Restaurant, cafe	3.0— 5.0
Show windows	10.0—50.0
Stores, barber shop	5.0— 7.0
Stores, books and furniture	3.5— 4.0
Stores, clothing, dark colored	5.0— 7.0
Stores, clothing, light colored	3.5— 5.0
Stores, drugs, jewelry, shoes, confectionery	4.5— 5.0
Stores, dry goods	4.0— 7.0
Stores, general illumination	2.0— 4.0
Stores, hardware, etc	4.0— 5.0
Stores, tailor shop	5.0— 7.0
Theaters	1.0— 3.0
Theater lobby	1.0— 3.0
Train sheds	1.5— 2.0
Travelers' coaches	2.5— 3.0
Warehouses, storerooms	1.0— 1.5

The intensity for the same class of service may vary considerably and will depend on the nature of the objects observed, the quality of the light and the results desired. Thus in factory lighting an intensity even lower than those in the table will be sufficient if the work is of a coarse nature, while in the manufacture and adjustment of intricate and complicated devices the highest value will be necessary. Again, in show window lighting the illumination is often for spectacular effect and should be several times that necessary clearly to distinguish the details of the objects displayed. In this latter case the object is not only to light the contents of the window but to attract the attention of the people passing.

The intensity depends also upon the color of the objects of observation, or upon their reflecting power. Thus, in stores displaying light-colored goods, less light will be required than if the colors are black or of dark shades. The quality of the illumination also influences to a considerable extent, the value of the necessary intensity. When the eye is exposed to bright rays of light the pupil contracts and the sensibility of the eye is decreased, and a higher intensity of illumination on the object is required in order to bring out the same clearness of detail. Also, too high a value of illumination on the subject of observation will produce a glare which will impare the acuity of vision and cause annoyance. But this glance may not be directly the result of the high intensity, but may be due to the nature of the luminous source, and to the superficial constitution of the object illuminated. In some classes of lighting, as in the display of jewelry, silverware and articles of like nature, glare is desirable and gives life to the appearance of such merchandise. On the other hand, where the light is for the purpose of distinguishing details and where the comfort and welfare of the individual is to be considered, the light should be well distributed and well diffused, and the illumination comparatively uniform. The intrinsic brilliancy of the radiating source of commercial illuminants is usually so great that diffusing media of the nature of frosted or opalescent glassware are necessary to give this soft diffused light in cases where the direct rays from the source are utilized. This effect is further increased by using reflectors. A most satisfactory equipment for obtaining the above results consists of a frosted-tip tungsten lamp, provided with a prismatic reflector having a sand-blasted or enameled interior surface.

The indirect lighting system gives a better diffused illumination than the direct system, but its efficiency from an economical standpoint is obviously somewhat lower. However, a comparative study of these two systems from a physiologic basis and of the results of actual observation of commercial installations will show conclusively that the difference in power consumption for illumination of a satisfactory intensity in each case is not so great as is generally supposed. The reason for this is that the better the diffusion of the light, the lower the intrinsic brightness of the source, and the farther it is above and out of the line of vision, the less will be the intensity of illumination for the same acuity of vision. Consequently the values of the intensity of illumination in the preceding table should be somewhat less when applied to the indirect lighting system, and the exact ratio will be different for various types of installation.

(To be continued.)

Tungstens for Automobile Lighting.

Some successful experiments on the use of tungsten lamps for automobile headlights have recently been made in Stroudsburg, Pa. With a thirteen-candlepower light it is reported that ordinary objects could be distinguished through a distance of 500 feet, and that a wagon or carriage could be seen at a quarter of a mile.

Electric Light Poles for Shaded Streets.

Work was begun the first of this month on the erection of steel electric-light poles of unique pattern on a portion of Lake Avenue Rochester, N. Y. The problem was to illuminate the roadway and sidewalks as well as possible without cutting the shade trees on the thoroughfare in question. For this reason the lamps are to be suspended a short distance beyond the curb by means of fourteen-foot cranes attached to the poles, thus avoiding the tree branches.

The steamboat Theodore Roosevelt, which has been chartered by the Trade Extension Committee of the Chicago Association of Commerce to make a lake trip in June, will be completely equipped with electric lights and powerful searchlights.

Electrical Recording of Heart Sounds.

The following interesting item is taken from a review by John G. McKendrick which appeared in a recent issue of *Nature*, of London, Eng.:

Hürthle was the first to succeed in registering the vibrations of the heart sounds. This he accomplished in 1892. His method was dependent on the use of a microphone. A delicate microphone was placed on the prongs of a wooden tuning fork, and the latter was attached to the end of a large wooden stethoscope, resting on the chest wall, over the apex of the heart. The vibrations thus communicated to the microphone altered a current flowing through an electromagnet, below which was placed a Marey's tambour (having a thin iron disk fixed to the india-rubber), and this, in its turn, transmitted its movement to a second very sensitive tambour, which recorded on a rapidly moving surface.

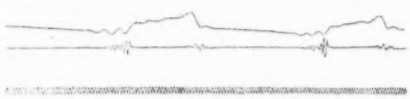
Soon afterwards, Einthoven investigated the subject by means of a microphone and capillary electrometer, and succeeded in registering with great accuracy the two tones. Then he employed his remarkably sensitive string galvanometer, and by means of this instrument, and with the aid of photography, the beginning, duration, and ending of the first and second sounds were recorded. Even in records from the impulse of the apex, which shows numerous vibrations, those associated with the heart sounds are readily identified. There can be little doubt that the string-galvanometer method is most to be depended on.

Holowinski developed a method by the construction of a kind of optical telephone. In the center of a telephone disk, a plate of glass, like the cover glass used in histology, was brought against a plano-convex lens, and in this way, when sounds caused the telephone plate to vibrate, the interference rings of Newton were produced. These varied with the heart tones, and, by a photographic method, when the picture of the variations was obtained, along with a superposed cardiogram (registration of movements of apex impulse), Holowinski gave an interpretation showing the position of the tones. The picture so produced, although beautiful and interesting physically, is rather confusing.

Marbe devised a very delicate Marey's tambour, or rather capsule, by which the vibrations of the heart-tones regulated the flow of a current of acetylene gas. This passed to a burner. The flame moved up and down with each vibration, and it was allowed to impinge on a moving band of paper. On this, with each vibration, a ring of soot was formed, and a picture of the heart tones was imprinted on the paper. This method is easy, and the results are easily interpreted.

Another method has been devised by Gerhartz. He cause a membrane (which received the sound waves) to carry, vertically to its surface, a delicate glass rod, which, at the other end, bore a small metallic mirror, placed between the poles of an electro-magnet. The arrangement is somewhat complicated, and it did not give striking results.

The last method we shall notice is that of Prof. Otto Weiss. It is entirely mechanical, and is independent of microphones and electrical appliances,



HUMAN HEART SOUNDS.

The upper curve is a cardiogram of the apex beat. The lower is that of one-hundredth of a second. The middle curve shows the heart sounds. Read from right to left. The first sound is the larger tracing. (Weiss).

being a clever modification of the phonoscope, by which, some years ago, many were amused by watching the play of colors produced in a soap film by the sounds of speech. Weiss's method consists in the employment of a soap film, in the center of which there is attached the end of a silvered thread. The other end of the thread is fixed to a lever connected with a carrier. Vibrations are carried by a special funnel-shaped tube from the heart to the phonoscope. This is enclosed in a box having in its walls lenses so adjusted that a photograph can be taken of the silvered thread and of its movements. The photograph, of course, is taken on a moving sensitive plate. The inertia of the system is remarkably small, the weight of the soap film and of the lever being about 0.000054 of a gram. All the parts are extremely light. The apparatus is so sensitive that the vibrations of a whisper can be recorded; the swing is aperiodic; and its moment of arrest is one-hundredth of a second. It is said to follow very frequent vibrations. An example of a tracing thus obtained is given in the figure.

In his interesting monograph, Professor Weiss gives examples of tracings of cardiac sounds along with the carotid pulse, of fœtal heart sounds, of the modifications of the sound caused by mitral insufficiency, mitral stenosis, aortic stenosis and insufficiency, and of anæmic sounds. All this shows the possibility of employing the method for clinical purposes. Finally, by an ingenious arrangement, Professor Weiss has been able to reproduce the sounds by means of a telephone. A flame from a suitable lamps falls on a selenium cell in the circuit of which is a telephone. Interposed in the path of the beam of light, a disk is rotated having the curves of the heart sounds cut out on its margin. As it rotated, the effect of the intermittent light on the selenium cell is such as to reproduce the heart tones in the telephone. Such an arrangement may be useful in teaching.

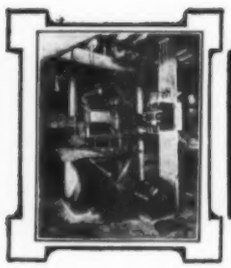
Lighting of Street Signs at Night.

A recent dispatch from New York city states that the Merchants' Association has requested Borough President McAneny of Manhattan to consider the adoption of a better type of street sign than those now in use. Complaint has been made that although the ordinary enameled sign is effective in daylight, it is practically illegible at night. It has been suggested that this defect may be overcome by so placing the signs on an arm or bracket, so that they will be illuminated by the light placed above, instead of being cast into shadow as at present. The Borough President will soon take up the matter, and will also seek to provide proper posts for signs at the numerous street corners where they are now lacking.

Arc Lighting in Canada.

A sample electric arc which has been erected on one of the streets in Owen Sound, Ont., proved so satisfactory that a larger installation will doubtless be made. It is proposed to place thirteen arches in a space of two blocks, which, burning until eleven o'clock every night in the year would cost approximately $6,800.

A movement is on foot in Hamilton, Ohio, not only to light one of the streets with electric arches, but to cover the street in part with a plate glass canopy. This protected and well lighted street will become the city market and it may be supposed that it will be a popular refuge during storms.

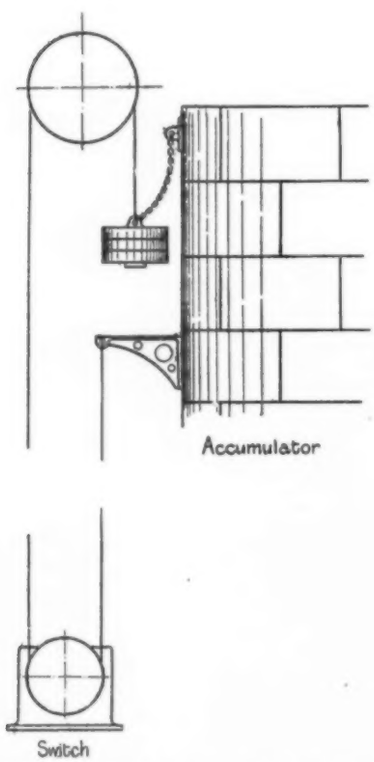


Industrial Power

AN ELECTROHYDRAULIC PUMPING PLANT.[1]—II.

BY W. A. CLATWORTHY.

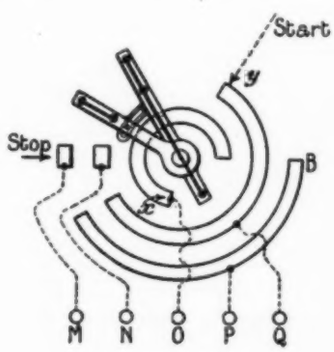
Accumulator Switches.—In the accumulator house are three rotary switches controlling the relay circuits of the pilot motor on the starting switches. These switches are rotated by wire ropes from the accumulator. One end of each rope is fixed to the accumulator, the



SWITCH OPERATED BY ACCUMULATOR.

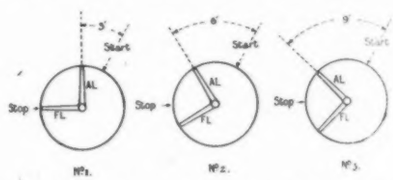
rope then passes down to the floor level where the switches are located, and takes a couple of turns round a pulley, which engages with the switch spindle by internal spurgear; the rope then rises to the roof, passing over another pulley, where the other end is secured to cheese weights. For purposes of safety in case the rope should break these weights are secured to the accumulator by a short length of chain. The friction of the rope on the pulley is quite sufficient for driving without any slip. Each accumulator switch is mounted on a marble base and fited in a cast-iron box; the switch spindle is positively driven from the pulley and gear through porcelain insulators on pins forming a kind of flexible coupling highly insulated. The fixed contacts are arranged in rings around the spindle; the movable contacts are of the plunger type. The switch has two levers which are adjustable relatively to one another in an angular direction for varying the period between starting and stopping. The total angular movement of the switch corresponds exactly with the total travel of the accumulator. To set the switch levers in the first instance it was only necessary to slacken the wire rope and move the pulley round.

In order to reduce the frequency of starting and stopping as much as possible when two sets of pumps were at work, it was necessary to so adjust the switch levers that the second set of pumps not only started after but also stopped before the first set working in conjunction with it. The diagram shows the positions of the levers as set on the three switches. *F L* represents the lever which is fixed to the switch spindle, and *A L* represents the second lever, which is adjustable relatively to the first.



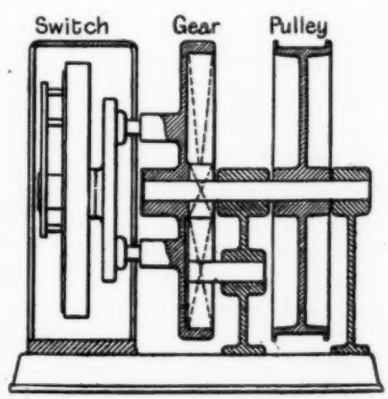
ROTARY SWITCH.

When No. 1 and No. 2 pump sets are switched into circuit, No. 1 will start up after the accumulator has fallen, say, three feet. If, now, the demand for power is less than the supply, the accumulator will rise and the pumps will be stopped when the accumulator is within about a foot from the top of its travel. If, however, the demand exceeds the supply the accumulator will fall a further three feet, when No. 2 pumps will start. If the accumulator



POSITIONS OF LEVERS ON SWITCHES.

ascends under these conditions No. 2 will come to rest within about three feet from the top and No. 1 will either take the accumulator to the top or allow it to again descend. If, on the other hand,



SWITCH AND DRIVING MECHANISM.

the accumulator still descends with No. 1 and No. 2 at work, then No. 1 will go on top speed first, the lever of the rotary switch having reached the point *B*, where current passes, exciting the solenoid of the field regulating switch. A further descent of three feet brings No. 2 set on to top speed also in a similar manner.

The control of sets 2 and 3 and 3 and

[1] From a paper delivered before the Newcastle (Eng.) Section of the Institution of Electrical Engineers.

1 in combination is the same excepting that while No. 1 starts three feet from the top and stops at the top No. 2 starts six feet from the top and stops three feet from the top. No. 3 also starts when nine feet from the top and stops within six feet from the top. It will be seen, therefore, that without the use of a selecting switch to change over the several accumulator switches to the several pumps that when such a combination as Nos. 1 and 3 occurs the accumulator must fall nine feet before one set of pumps will start, with the result that one set will follow the other in quick succession.

In practice, however, it is found convenient for sets 1 and 2 and 2 and 3 to be used in turns for tide work and for No. 3 to do most of the work in between the tides. This equalizes the work on the several pumps fairly well.

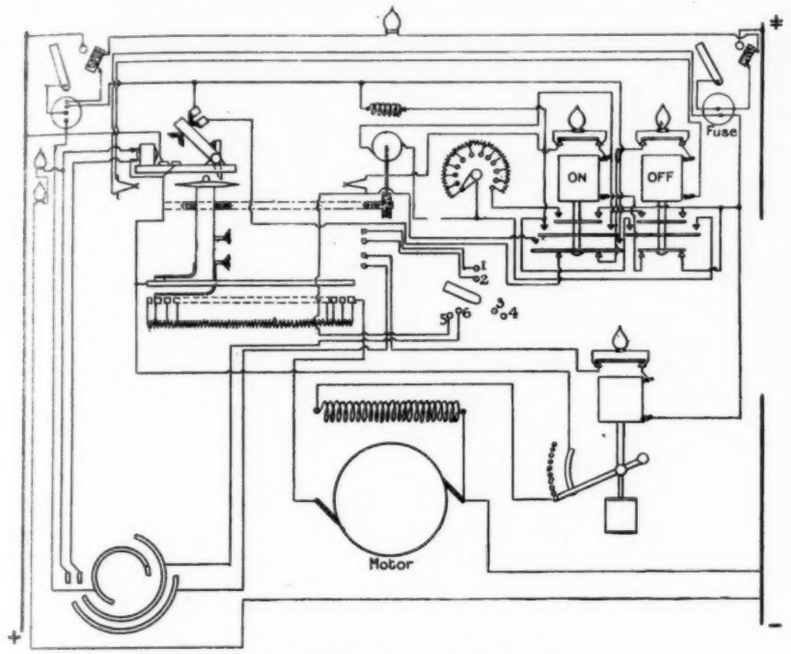


DIAGRAM SHOWING CONNECTIONS.

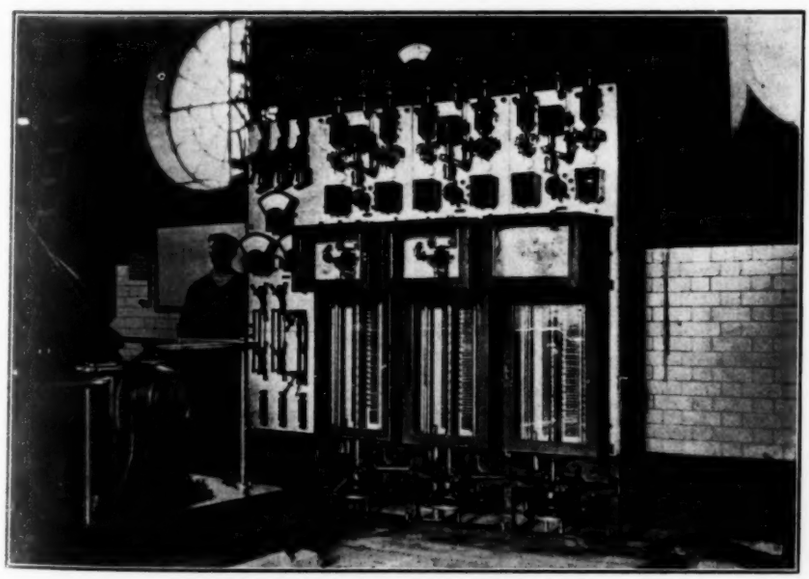
It will be seen from the diagram of connections that when rings x and y on the accumulator switch are connected, current excites the solenoid of pilot-motor switch for starting the pumps; it may happen at such a moment, however, that the demand for power suddenly ceases, and the first few strokes of the pump cause the accumulator to rise and consequently the lever to fall away from contacts x and y, so in order to prevent the solenoid switch breaking circuit and thus causing the starter to remain in an intermediate position between "off" and "on," special contacts are provided by which the circuit to this solenoid when once made by the accumulator switch is maintained until the starter has reached the limit of its travel.

It will be seen from the foregoing that it is quite simple if preferred to put the relay automatic system out of action altogether. The starters would then be started up by hand, handwheels being provided at the end of the screws and the pumps run continuously, the water being by-passed in the ordinary way at the top limit of accumulator travel.

From observations of the plant in working it was found quite common for a set of pumps to start and stop as often as twenty to twenty-four times in an hour, and again a set has been known to run for four or five hours without stopping. The work is very variable and depends on the demand for power for several swing bridges, lock gates, cranes, etc.

When the first set of electric pumps had been installed it worked quite satisfactorily for some time, sharing the load with one of the steam sets.

Under tests conducted by the Bristol Docks officials, an efficieney of eighty-two per cent was obtained, reckoned upon the displacement of the rams against the current used by the motors.



SWITCHBOARD AT THE BRISTOL DOCKS.

Reduced Cost by Electric Pumping.

Advices from Wahpeton, N. D., state that the changing over of the city pumps from steam to electric operation has been accompanied by a great reduction in cost. Heretofore the coal alone cost $18.00 a day, while the electric power for running the pumps costs only $6.00 a day. The power is obtained from hydroelectric plant near Fergus Falls.

Sixteen of the new Edison storage battery cars have been ordered by the officials of the Twenty-eighth & Twenty-ninth street crosstown line. In the three weeks' test of the car on that line it was operated at a cost of only 4.3 mills per mile.

TELEGRAPHY—TELEPHONY, and WIRELESS.

Telephone Circuits.

At a recent meeting of the Physical Society of London, Eng., a paper on "Telephone Circuits" was read by Prof. John Perry, and a good discussion followed.

The author published a paper in the Proceedings of the Society in 1893, showing how voltage v and current c are attenuated along a telephone or submarine-telegraph line, a line with resistance r, capacity k, inductance l, and leakance s per unit length; currents are of the form sin qt. When lq/r is considerable the mathematical expressions become simple. It was pointed out that the introduction of l is of great benefit. The author now points out that k may be made negative by the use of inductance leaks to earth, and l may be made negative by the use of condensers in series with the line. To introduce l as Mr. Pupin has done by inductance coils at equidistant places on the line, or to introduce the other properties mentioned by placing other contrivances at equal distances, is a methematical problem of great complexity. Contrivances placed close together have the same effect as the continuous distribution of properties, but there is considerable expense; the problem is to find how far apart the contrivances may be placed so that the effect produced shall still be beneficial. Mr. Pupin has given a rule for the spacing of his coils, but practical men dispute its accuracy; nobody has given a rule for other contrivances; the object of the author is to give an easy method of calculation which is practically correct and which can be used when the contrivance is any network or other combination of resistances, inductances, and capacities—some being leaks to earth—and it may include transformers, motors, and generators.

Suppose there are contrivances at the equidistant places A, B, etc., m miles apart in a cable which has the above mentioned properties r, k, l and s. There is a contrivance whose terminals are A and A_0, another whose terminals are B and B_0; between A_0 and B there are m miles of cable. Let the currents in the line at A, A_0 and B be c, c_0, and C. Let the voltages at these points be v, v_0, and V. The assumption on which the whole method is based is that $V/C=v/c=\rho$. This is practically true everywhere in a long line except near the ends. Now whatever be the nature of the contrivance we can calculate v_0 and c_0 from v and c. It is also known that

$$V = v_0 \cosh mn + \frac{r+lqi}{n} c_0 \sinh mn,$$

$$C = c_0 \cosh mn + \frac{n}{r+lqi} r_0 \sinh mn,$$

when $$n = \sqrt{(r+lqi)(s+kqi)}.$$

Putting V/C or ρ equal to v/c we have a quadratic to calculate ρ and therefore V and C, and the problem is solved. Taking $c=\sin qt$ and calling it 1 then $v=\rho$. Whatever the contrivance may be we find that $V=\alpha+\beta\rho$ and $C=a+b\rho$, where α, β, a, and b are given in value; they are usually unreal quantities of the form $M+Ni$ where i is $\sqrt{-1}$. Solving for ρ and finding C we have two answers which are reciprocals of one another. If $\frac{1}{2}(a+\beta)$ be called P, and this is very easily evaluated,

$$C = P \pm \sqrt{P^2 - 1}.$$

Examples of the use of the method are given, some showing that the detached contrivances produce much the same and others very different effects from what might have been expected from a study of the cable with continuous properties. It was shown that a line may have contrivances somewhat far apart which will tune it to a musical note merely, so that it acts almost like an ohmic resistance, but which will not transmit well the currents of other frequencies, and that for the commercial transmission of speech there must be a compromise. The author impressed on the audience the fact that his method of calculation could be taught to quite non-mathematical people.

Major O'Meara thanked Professor Perry for his very interesting and useful paper, and wished to assure him on behalf of a very large body of telephone engineers that they much appreciated the assistance which he and other mathematicians had rendered by their mathematical statement of the engineer's case. The equations given were of the same value to engineers as the compass was to the mariner. The only question they were in doubt about was whether all the forces that come into play had been equated. They consequently made a preliminary investigation of the manner in which the equations had been built up, and this convinced them that certainly the most important of the forces had been introduced into the equation. Some of them were responsible for the expenditure of large sums of public money, and the fact that they had something reliable to guide them in making their recommendations had removed a considerable amount of anxiety. As a matter of fact, at the British post office they had for some time past actually applied the formulas, and had obtained a considerable amount of success in doing so, so far as the introduction of loading coils was concerned. For instance, a short while back the question of a new cable between England and France was under consideration. It had been stated in foreign technical journals that the formula for "loaded" cables did not apply to the case of conductors covered with gutta-percha, owing to the very large electrostatic capacity introduced and the peculiarities of the insulation. Although he (Major O'Meara) had faith in these formulas, still he felt that a practical experiment would remove all doubt, and in consequence he arranged an experiment with some old No. 7 gutta-percha wire, *i. e.*, copper wire weighing forty pounds per mile covered with fifty pounds of gutta-

percha per mile, which had a resistance per loop mile of forty-four ohms, and an electrostatic capacity wire to wire of 0.13 microfarad per mile.

The gutta-percha wire was immersed in a tank, and experiments were conducted on lengths varying from fifteen to 105 miles. They did not design special coils, but made use of some already in stock. These coils had an inductance of eighty-three millihenries, and a resistance of 13.4 ohms at 750 p.p.s. Admittedly the coils were not the best for loading this particular type of cable.

Having decided to place these coils at one and one-half-mile intervals, that is, to insert fifty-five millihenries per mile, they calculated the attenuation constant which would result. It worked out at 0.0427 per mile. When the coils were inserted and the experiment completed, the observed attenuation constant was found to be 0.0419 per mile. From this it was evident that the calculated and observed results practically agreed.

The information thus obtained enabled them to deal with the question of the new submarine telephone cable, and they decided that the attenuation constant for this cable should be 0.0147 per mile, to be obtained by the insertion of coils at one nautical mile apart. The coils have a resistance of slightly less than six ohms, and possess an inductance of 0.100 henry at 750 periods per second.

The cable has been manufactured and tested; the actual observed attenuation constant is 0.0140 per mile, so that this again proved the value of the formulas.

The new telephone cable consists of 160 pounds of copper wire and 300 pounds of gutta-percha. It has a conductor resistance per loop mile of 12.5 ohms (excluding the coils) and a wire to wire capacity of 0.12 microfarads per mile. In an unloaded state, the attenuation constant of this cable is 0.045 per mile.

Major O'Meara mentioned that the question of leakance was certainly of very great importance. It was owing to the very large part that leakance played that their first experiments were not successful. In America they had commenced to load aerial wires, and so large a part does this leakance play that in that country telephone engineers had been obliged to abandon the use of glass insulators, and substitute the highest grade of porcelain insulators to meet the difficulties which had been met with owing to an insufficient allowance for the part this factor played. He feared that in no case could leakance be neglected, whether aerial or underground conductors were used.

A. W. Martin said that most telephone engineers in this country and America considered that a circuit should be capable of transmitting currents of frequencies varying from 100 to 2,000 cycles per second in order that good clear speech might result. For attenuation calculations, some take 750, and others 800 cycles per second as a mean value. When lq and kq are great compared with r and s respectively,

$$h=\frac{1}{2}\left(r+\frac{sl}{k}\right)\sqrt{\frac{k}{l}},$$

and writing $s=0$, $h=\frac{r}{2}\sqrt{\frac{k}{l}}$.

The question is not whether $s = 0$, but whether the ratio of s to k may be regarded as zero, since both are small quantities. In practice s/k is found to be far from negligible when inductance is placed in the circuit. When inductance L with resistance R is placed in leak, and assuming R small relatively to Lq, the impedance takes the place of ordinary insulation resistance and is practically equal to Lq. The transmission efficiency of the whole circuit for low telephonic frequencies would be low, and there would be an appreciable C^2R loss in the leak coils. When lq is not great compared with r but where the insulation resistance is much above a megohm per mile, s may be neglected without causing calculated and observed results to differ materially. The expression then becomes

$$\sqrt{\tfrac{1}{2}qk(\sqrt{r^2+q^2l^2}\pm ql)}=g\,(+)\text{ or }h\,(-).$$

If r be high compared with ql no great error is made by writing

$$g=h=\sqrt{qkr/2},$$

but as l in cable loops is never less than 0.001, it cannot be neglected except, say, when r exceeds fifty ohms. The difference between the values of g and h becomes great as r becomes small. A circuit tuned to a particular frequency would be useless for telephone working but might prove of value telegraphically. The ordinary paper and wax insulated, thin lead-foil plate condenser offers resistance to the transmission of high-frequency currents, and the insertion of such condensers in a telephone loop would be accompanied by a C^2R loss. Experimental results show that improvements of 370 per cent by coil loading (Pupin method) may be obtained in telephone loops. The eighteen-ohm per mile cable mentioned in the paper had a measured attenuation constant of 0.045 per mile before loading. After the insertion of certain coils at 3.2 mile intervals, each coil having an inductance of 0.133 henry and offering an effective resistance of 5.4 ohms at 750 cycles per second, the observed attenuation constant per mile was 0.012, which result is fairly in agreement with the value of 0.013 obtained by calculation at 750 cycles per second from

$$h=\frac{1}{2}\left(r+\frac{sl}{k}\right)\sqrt{\frac{k}{l}} \quad \text{where } \frac{s}{k}=80.$$

When the coils were placed at 2.1 mile intervals, calculation and observation gave the attenuation constant as 0.012 per mile. Coils with cores of properly chosen magnetic material give a higher inductance for a given effective resistance than air-core coils, and are therefore the better type. Experience shows that the quality of speech transmitted becomes bad when the number of coils per wave-length at 2,000 cycles per second is less than π.

Measurements taken on various lengths of cable, the copper conductors in which were continuously and closely wound over with fine iron wire, showed that this "continuous" form of loading produces an improvement of only sixty per cent upon the untreated condition in cases where the copper is of two square milimetre area and upwards. With smaller conductors it may possibly reach as much as 100 per cent.

B. S. Cohen said that the impressions obtained after reading this paper were that Professor Perry had assumed that a telephone circuit tuned to the average telephonic frequency would as a result of this tuning transmit speech-waves more efficiently. He thought, however, that those who had studied this subject would agree that this was a misconception. He (Mr. Cohen) had previously pointed out that an average speech-wave consisted of a fundamental varying between 100 complete periods and 300 periods, the highest harmonic being about 1,500 periods, and the average periodicity of the whole wave 800 periods. He had also given the Fourier series obtained by analyzing a number of speech-waves, and this series showed that there are a large number of odd and even harmonics of approximately equal importance rang-

ing from the second to the eleventh harmonic.

This would in itself explain why it was not only useless but absolutely harmful to tune to any particular frequency. Turning to the eighteen-ohm cable line referred to by Professor Perry, he gave some results worked out by G. M. Shepherd. When this cable is in the normal condition the attenuation for a wave with a value q (angular velocity) of 1,000 is 2.2 per cent, for a value of 5,000 it is 3.1 per cent, and for 9,000, 6.4 per cent. This covered the whole commercial speech range, so that the variation over this range for attenuation is about 300 per cent. Using Professor Perry's formula and taking his contrivances adding .593 henry per mile and a capacity of .44 microfarad in series, it will be found that the variation of attenuation between $q = 1{,}000$ and $q = 5{,}000$ is 500 per cent. That is to say, up to the average frequency alone the variation in attenuation is 200 per cent more than over the whole range of speech frequency with the normal cable. But going a step further for an angular velocity of 5,550, the attenuation constant is 0 and the current at the end of the line using the formula given is 0. This means that the inductance and capacity bridge act as a shunt of infinitely low resistance. Any further increase in the frequency results in a negative attenuation, implying that an entire change in the nature of the transmission takes place. It would be of much interest if Professor Perry would explain exactly what is the physical interpretation of this curious effect. Whatever the explanation, however, there is little doubt that the effect of this combination of bridges L and K would be satisfactory, as far as the commercial transmission is concerned, in spite of the fact that at 800 periods the attenuation is only thirty-three per cent, or an improvement for that particular frequency alone of about fifteen times over the normal line. Contrasting these results with those which would be obtained by the application of the ordinary Pupin series loading coils of 0.13 henry each spaced at one-mile intervals in the same line, the attenuation at any frequency over the range of telephonic speech is 1.1 per cent; that is to say, the volume improvement is five, and the line acts as a distortionless one instead of amplifying the natural distortion of the unloaded line. He mentioned that this was not only a calculated result, but one that was amply confirmed by everyday practice, and which included the effect of the effective resistance of the inductance. Since his paper at the St. Louis Congress, Professor Kennelly had written a considerable number of papers on the subject of telephonic transmission, and his formulas and methods were now adopted by many telephone engineers and were rapidly becoming standardized.

Dr. Russell thanked Professor Perry for his instructive paper. He much appreciated the methods shown of getting simple approximate formulas for some very difficult problems. It was interesting to compare the author's solution in the case when the leakance was zero with Heaviside's solution for a distortionless circuit. The only difference in the formulas was that the attenuation was twice as great in the latter case. The Physical Society was deeply indebted to Major O'Meara and the other speakers for the very interesting data they had given about Pupinized telephone lines. From the theoretical point of view it was exceedingly satisfactory to find that the "loading coils" fulfilled their functions so efficiently and that their performance could be predicted so accurately.

Dr. J. A. Fleming and G. M. Shepherd also sent in communications.

Professor Perry communicated a reply, which was in part as follows: "I am afraid that my paper has been a little misunderstood by the critics. They seemed to think that I was advocating the use of a contrivance consisting of condensers in the line and an inductance leak, whereas I mentioned this contrivance merely to illustrate my paper. What I have endeavored to do is to show how calculations may be made by non-mathematical people to find the effect of using any contrivance whatsoever."

A New Method of Investigating Coherers.

At a March meeting of the Physical Society of London Dr. W. H. Eccles in the course of a paper on coherers developed a method of investigating detectors, with special reference to the relations between the energy given to the detector in the form of eletrical vibrations and the energy delivered by the detector, as direct current, to the circuit of the indicating instrument. The stream of energy supplied to the detector was always of the same order as that usual in telegraphy.

The detector under examination was placed in a circuit containing suitable inductance and capacity which was secondary to a primary circuit. The primary could be set into electrical vibration by breaking a known current in it. The coupling was very small, so that when a current of a few milliamperes was broken in the primary, the energy delivered to the detector was of the order of a thousandth of an erg, and the electromotive force at the coherer terminals was of the order of a tenth of a volt. The response of the detector was measured by comparing the sound in its telephone with the sound produced in the same telephone by interrupting a measurable direct current. A special switch key enabled the comparison to be made quickly.

The power delivered to the detector and to the telephone was determined by extrapolation from measurements on stronger currents with the thermo-galvanometer. The results of experiments on coherers made of oxidized iron wire dipping into mercury, and on coherers made of a clean iron point touching an oxidizing iron plate were exhibited in a number of curves by Dr. Eccles. An interesting discussion followed in which Messrs. W. Duddell, C. H. Lees, Rayner, Russell and Campbell took part.

A paper on earth-air electric currents was read by G. C. Simpson, describing a method for automatically recording the electrical current which passes from the earth into the air during periods of fine weather. In the discussion that followed, Dr. Russell said it was customary to suppose that ultra-violet rays improved the conductivity of the atmosphere, and this supposition was a help in explaining why radio-telegraphic waves went further over the ocean by night than by day.

A. H. B.

Glidden Tourists to Use Wireless.

Owing to the fact that the Glidden automobile tour this year is routed through a section of the country where telegraph and telephone facilities are very poor, it has been decided to equip the cars with wireless outfits in order to enable the contestants to report accidents, etc., and to keep in touch with the authorities of the tour and with the towns ahead. The innovation will be watched with interest.

ELECTRICAL Advertising *and* Selling

MAKING THE MOST OF ELECTRICITY AS AN ADVERTISING MEDIUM.—II.

BY CHARLES A. PARKER.

Even at the risk of giving too much space to this phase of our subject we must at least enumerate the other "fields" to which the central station should devote attention if it is going to "make the most of electricity as an advertising medium."

The wholesale district, for instance, of towns large enough to have a "really-truly" wholesale district is generally darker than it ought to be. A few electric signs scattered about would be a good thing if for no other reason than to locate prominent firms to buyers who may be in from out of town. They may serve to advertise specialties. On the central station's side, it should not be forgotten that every sign put up will breed more signs and bigger signs so no opportunity, however small or remote it may seem, should be neglected.

Somewhat aside from the utility of the electric sign but worthy of mention here is its value as—shall we call it—a "directory medium." There seems to be an endless variety of uses to which signs can be adopted for purposes of this sort and fertile brains are constantly busying themselves inventing new ones. It should be a part of the central-station's advertising program to make as much of this feature as possible. The first electric sign on a church was noted as a novelty. Now they are comparatively common and will become still more common if the central station gets busy. In this connection, banks, police stations, public institutions, etc., must be taken into consideration. Indeed, in one city transparent house numbers which are really nothing more than small electric signs showing illuminated figures at night are making great headway.

Probably the most recent sign feature however is what might well be termed the "syndicated electric signboard." Two types can be called to mind, one a large display sign with changing signs beneath it, the other nothing more than an illuminated sign board that shows the advertisement of a number of different firms. One of the most elaborate "syndicated" signs know was erected recently by a sign company in connection with the central station and represents in an exceedingly realistic manner the Ben Hur chariot race. The space below the race is shared by a large number of firms whose advertisements appear in rotation. In addition to giving both the lighting company and the sign concern effective advertising this sign is the source of a tidy little income for all concerned. The illuminated sign board scheme may be worked on the company's own behalf or in connection with some bill posting firm. It must not be overlooked also that many firms can be induced to have their own large bill boards illuminated electrically if they are approached often enough and in the right spirit.

This much for "The Work To Be Done." The writer has given it more space than may seem justifiable to some. He has done so, however, because he feels that too much emphasis cannot be laid upon the fact first stated—namely—that the subject is a live issue. And if anything could show this to be a fact, a discussion of the work to be accomplished would do so. The question of "how it is to be done" follows very naturally in the train of the points that have occupied us this far.

HOW SHALL THE WORK BE DONE?

The old adage to the effect that it is easier to tell how a thing should be done than it is to do it never found a more fitting application than here.

It is simple enough to say that that central station will "make the most of electricity as an advertising medium" which is most enthusiastic, persistent, and intelligent in its advertising and which follows up this work by soliciting that is equally as enthusiastic, persistent and intelligent. It is quite another matter, however, to tell how these qualities may be injected into central-station advertising.

This difficulty does not, however, lessen the necessity for the qualities mentioned. Enthusiasm is as essential to good advertising as a good circulation of blood is to the healthy animal. Without enthusiasm, advertising never fails to be perfunctory. It lacks the power to convince. It is for all the world like a spent bullet. Every bit of power it has is used to carry it along and when it hits and is called upon to "do the damage," it falls helplessly to the ground.

Of course, enthusiasm is not the easiest thing in the world to generate. And once "generated" it is not the easiest thing in the world to keep up. As was suggested before, the enthusiasm that comes with the newness of a proposition soon dies down. Central-station advertising has passed through this stage and must find some substitute for this pioneer spirit.

It does not require much erudition to see that any permanent enthusiasm must come from the merits of the proposition. If it has none of real value, then, with the death of early enthusiasm, the proposition dies. But who would be so rash as to say this of the use of electricity as an advertising medium? If an advertising man cannot be enthusiastic even to the point of fantical devotion over this phase of electrical endeavor, he cannot be enthusiastic over anything. But just as soon as he goes into the matter to the very depths and studies it from all its various angles and in all of its ramifications, he will be enthusiastic about it. And his enthusiasm will be reflected in his advertising to the profit of the central station.

Persistency, the second great essential, is the outgrowth of enthusiasm and quite as important to complete success. It is keeping everlastingly at it that ac-

complishes things. Many hundreds of dollars have been thrown away in advertising because the man in control of the purse strings shut off the flow just when a few more dollars would have done the work. Of course the sooner results come, the better. But if they do not come early there is no reason for getting cold feet and quitting. Keep at it. It has taken years of effort and hundreds of thousands of dollars to make each letter of the word "Royal" over a million to the manufacturers of a certain baking powder but they are reaping a rich reward as a direct result of their enthusiasm, persistence and intelligence.

Intelligent advertising is of course the keystone to all else. People mentally unbalanced are often quite enthusiastic and altogether too persistent. Central-station advertising that is to "make the most of electricity as an advertising medium" must be intelligent.

WHAT IS "INTELLIGENT" ADVERTISING?

And what, exactly, do we mean by intelligent advertising?

It implies, first of all, an exact and detailed knowledge of the things that are being sought, the ends to be gained. This is the fact which justified the detail with which we discussed the work to be done. The advertiser who does not quite know what it is he wants to accomplish can no more be expected to accomplish anything than the marksman can be expected to hit a target when he does not know what he is shooting at. This may seem so axiomatic as to make a statement of it appear ridiculous. Unless an advertiser settles right down to a clear mental conception of the thing he really wants to do, it is the easiest thing in the world to go astray.

An essential part of knowing what he is after is the central-station advertiser's knowledge of the man with whom he must have dealings. The lack of such knowledge cannot but result, as was suggested in a previous article, in one of two equally fatal mistakes. Either you will overshoot the mark by making your appeal too far above your man's comprehension or you will undershoot it by making your appeal so puerile that he will be apt to regard it with contempt. The only certain way to get your man is to know your man.

With these fundamental requirements satisfied we have a good basis for our believing that our advertising to "make the most of electricity as an advertising medium" will accomplish its purpose provided that one other important condition is fulfilled. And that one remaining essential is this: In addition to these qualities we have discussed your successful central-station advertiser must have complete command of the means at hand and an ability to apply them in the most effective manner possible. That is to say, he must be able to spread his advertising appropriation in the way that will do the most good. If, for instance, as is generally the case, his prospects can be readily determined and are few enough in number to go after by mail, it would be utter folly to expend most of his appropriation for newspaper space. But he should be able to make decisions based upon much subtler considerations than this. He should have his list so well classified and so completely within his comprehension that he would know at what seasons of the year and to just what extent he could pound away at certain names.

Now then, to get down a little more closely to the subject in hand, the writer believes we may consider the end we are seeking to be fairly well understood. This being the case, we can turn our attention to the men we are after.

THIS ADVERTISING GOES TO MERCHANTS.

Merchants compose about ninety-nine and two-thirds per cent of the class to whom we must go, men of dollars and cents, men to whom a good investment that brings in a good per cent profit is "a thing of joy and a beauty forever" and to whom an expense is a dire tragedy. If we can convince a man of this type that money spent for electrical advertising is not an expense but an investment, and an investment that will bring them in greater returns than if the money were laid out in some other fashion, he will go the limit. Therefore he must be made to see that electric signs, electrically lighted show windows and an electrically illuminated store are going to mean more dollars for him. Every advertisement that doesn't, in one way or another, point to this conclusion misses fire. To this end, he must be made to realize that he is not buying light but advertising. One central station, appreciating this fact, has established what it calls its "Merchants Publicity Department" and its bills read not for so much current consumed but for so much "electrical advertising service." They may be stretching a point but they have the right idea.

"But," may object some central-station advertiser, "we can't content ourselves with saying 'Electric Signs make Profits Grow' until the geese come home. If we do the geese won't come home."

True, indeed! But that, nevertheless, must be the predominating note and the idea fixed in your man's mind before he will come around.

The question of exciting his curiosity, rousing his interest, and holding his attention is quite another matter. These things must, of course, be accomplished, and to accomplish them, you must appeal to practically every phase of human nature. You must take advantage of man's love of novelty and humor. You must hold his attention by your very earnestness and play upon his civic patriotism, but underneath the whole matter there must be a strong strain to the effect that "there's money in the electric sign for the man who has one."

INDUCING ACTION.

After you have convinced your man even to the point of enthusiasm, there is still his natural indisposition to act to be taken into consideration.

This is the last obstacle to be encountered and the hardest to overcome. With this fact in mind, a few general suggestions may not come in amiss.

The most important of these is the necessity of making action easy. A large amount of advertising fails because, while it is strong and convincing enough it closes by leaving the prospect up in the air with nothing to do. Always suggest some easy and attractive course of action for your man to take. Try to make it easier for him to act than not to act and be careful that the favorable action is made to appear the easiest and most natural.

Try, also, as near as possible to have your advertising carry a "special" air about it, keep it from appearing routine. If a man receives a booklet or folder that says on its face, "I am a piece of circular matter the central station is sending out as a matter of business policy and I come to you because your name happens to be on the

list," you lose at the very start. Such matter has an apologetic character that is fatal to its effectiveness. If, however, the recipient gets a piece of matter that makes him feel that, "well there must be new things doing in the electrical game," you stand a much better chance of winning out. Just at present, high efficiency lamps afford the central station its best opportunity for introducing this "special" character into its matter.

If, for instance, you are going after people who are already on your books, make a big stir about the wonderful improvements that have multiplied the effectiveness and economy of electricity as an advertising medium many times. Invite them to consult your experts in respect to these improvements and to get your advice on their illuminating problems.

Assume that if electrical advertising was beyond them before because of its cost that the newer methods of illumination brings it within reach. Excite their curiosity by your constant talk on the new lamp and make them come to you for information.

In conclusion let the writer suggest that one other important matter be not overlooked. See to it that the solicitor understands and is thoroughly imbued with the spirit of your advertising. See to it that he keeps in touch with the progress that is made so that he may back up its effectiveness with his own efforts and both working together enable the central station "make the most of electricity as an advertising medium."

Electric Power Booklet.

For a special booklet to emphasize the advantages of the electric motor for all power applications the most recent publication of the Central Georgia Power Company, Macon, Ga., may be mentioned as fulfilling every requirement of literature of this character.

The booklet is attractively bound and instead of containing lengthy arguments presents to the recipient seventeen illustrations of interesting applications of motors, covering nearly every class of motor drive.

Municipal Heating Plant Vetoed.

The City of Anderson, Ind., has decided by ballot in its first special city election ever held that it does not want a city heating plant municipally owned.

Educating Its Customers.

In the comparatively few instances in which it has been tried the plan of educating its customers in topics of the analysis of light, the art of protecting the eye from strain by scientific illumination in the home and office, etc., by means of public lectures and demonstrations has shown gratifying results to central stations.

The plan is at present in successful operation at Montgomery Ala., where the Montgomery Light and Water Power Company has engaged a competent illuminating engineer to deliver a course of lectures on "Electric Illumination."

These lectures which are held in a prominent theatre, aside from their instructive value are spectacular and attractive, a stereopticon display forming a part of the plan. Modern lighting appliances are considered in every phase, and the discussion includes a treatment of the various types of incandescent illuminants.

In many instances central stations will find the electrical manufacturer ready to co-operate with them in giving lectures of this nature and the expense will thereby be materially reduced. In any event the cost of publicity of this nature has always been justified by the results.

A newspaper in Billings, Mont., the *Daily Gazette*, is publishing in what is called the "Booster Section," a series of photographs showing the electric illumination of the streets and buildings of that city.

This novel scheme was inaugurated for the purpose of "proving to the world that Billings is the most progressive city in Montana and that its citizens are not in the least backward in the march of civic improvement."

Unique Advertising.

The Marinette Light and Traction Company, Marinette, Wis., is running a line of advertising in the local press under the head of "Fresh Air Talks," that is indeed commendable.

These advertisements set forth the hourly air supply for certain requirements, and ends by making an appeal in behalf of those who suffer from lack of fresh air supply, to call up the "fresh air man at the Light and Traction office, who will be pleased to exploit the electric ventilating fan."

Opening for American Vacuum Cleaners in Germany.

Consul-General Robert P. Skinner has looked into the opening in Germany for American suction cleaning apparatus, and writes from Hamburg:

"Catalogues and printed information in regard to vacuum cleaners of American manufacture having been shown to an extensive importer of miscellaneous American goods in Hamburg, have evoked the opinion that prices and terms being satisfactory these devices should be able to compete successfully with German and other machines now on this market. This informant was particularly struck by the compactness and apparently practical construction of the motors shown in the American designs and with the variety of devices proposed by American manufacturers.

"The extensive construction of large apartment houses and immense office buildings in the larger cities of Germany make the use of central suction plants with connections in all rooms entirely practical, while small householders are taking an increased interest in hand apparatus or the portable electric machines. Prices for the best German machine now on the market are from $50 to $100 for hand apparatus, and from $130 to $226 for the electric apparatus complete. These German machines are much ruder and more bulky than American machines."

The consul-general forwards the names of importing firms with whom it would be well to correspond for introducing such novelties into Germany. These addresses may be obtained from the Bureau of Manufactures, Washington, D. C.

New York City Railway Decision.

The United States Circuit Court of Appeals has handed down a decision upholding the appeal of William W. Ladd as receiver of the New York City Railway Company from the decision of the lower court dismissing the claim of that corporation for interest on notes given by the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company, and directing that the decrees of the lower court of June 15 and December 29, 1909, be reversed, "with instructions to the court below to enter a decree referring the same to the special master for further proceedings in accordance with this opinion."

BOOK REVIEWS.

"Elementary Course in Perspective." By Sherman M. Turrill. D. Van Nostrand Company, New York. Cloth, 71 pages, (4¾ by 7½ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.25.

In this treatise the author illustrates the mechanical application of the principles of descriptive geometry to the making of a perspective drawing. Two methods are used, the "method by the use of the plan" where the orthographic projections of rays are used, and the "method by scale." In the former, all details should be drawn with instruments, especially if there is much mechanical labor entailed. On the other hand the "Method by Scale" should serve the purpose, and is, in fact, the quicker process, where the accurate location of the leading or important points only is desired. The first method is, therefore, of assistance to the mechanical draftsman, whereas the second is intended for the artist and free-hand draftsman. This book is only recommended for those more or less familiar with descriptive geometry. The subjects taken illustrate important principles and are of general interest. In addition will be found a large number of problems covering these principles as applied to the illustrated subject, in a variety of positions. The text is well illustrated with figures.

"Theoretical Elements of Electrical Engineering." By Charles P. Steinmetz. McGraw-Hill Book Company, New York, N. Y. Cloth, 455 pages, (6 by 9¼ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $4.

This third edition, although appearing nearly eight years after the appearance of the second, retains practically the same contents which is not yet superseded or antiquated. However, very much new material is added as during the eight years apparatus and phenomena which at the time of the second edition were of theoretical interest only, or of no interest at all, have now assumed great industrial importance, as for instance, the single-phase commutator motor, the control of commutation by commutating poles, etc. Besides the rewriting and enlarging of numerous paragraphs throughout the text, a number of new sections and chapters have been added, on alternating-current railway motors, on the control of commutation by commutating poles, on converter heating and output, on converters with variable ratio of conversion, on three-wire generators and converters, short-circuit currents of alternators, stability and regulation of induction motors, induction generators, etc. In conformity with the arrangements used in his other books, the author has numbered the paragraphs of the text for easier reference and convenience. The special apparatus discussed includes synchronous machines, direct-current and alternating-current commutating machines, synchronous converters and induction machines.

"Illumination and Photometry." By William E. Wickenden. McGraw-Hill Book Company. New York, N. Y. Cloth, 195 pages (6 by 9¼ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $2.

The material of this book is the outcome of a course on illumination and photometry given by Professor Wickenden at the University of Wisconsin. As might be expected from a book intended for a text for the use of students in the advanced years of college work, the treatment is distinctly technical. Higher mathematics are freely used whenever a subject is capable of mathematical treatment. As a college text-book, this treatise possesses the advantages of being up-to-date, and of treating the pure theory of the subject in a clear and sufficiently comprehensive manner. A condensed form of treatment has been followed throughout. Emphasis has been given to the scientific basis of the subject and the methods of rational analysis rather than to the description of processes of manufacture, structual details and prevailing practice.

"Radiation, Light and Illumination." By Charles P. Steinmetz. McGraw-Hill Book Company. New York, N. Y. Cloth, 305 pages (9 by 5¾ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $3.

This book contains a series of thirteen lectures delivered before the senior students in electrical engineering at Union College by Doctor Steinmetz. These lectures are, however, intended not merely as a text-book of illuminating engineering, nor as a text-book on the physics of light and radiation, but rather as an exposition, to some extent, from the engineering point of view, of that knowledge of light and radiation which every educated man should possess. Therefore the lectures are given in such form as to require no special knowledge of mathematics or of engineering. Mathematical formalism has been avoided and the phenomena have been described in plain language, with the exception of lectures X and XI, which by their nature are somewhat mathematical and are intended more particularly for the illuminating engineer. In describing the experiments, numerical and dimensional data on the apparatus have been given, and the illustrations drawn to scale, as far as possible, so as to make the repetition of the experiments convenient for the reader.

"High Frequency Electric Currents in Medicine and Dentistry." By S. H. Monell. William R. Jenkins Company. New York, N. Y. Cloth, 465 pages (6 by 9 inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $4.

The value of high frequency currents of electricity in many acute and chronic conditions which are common in medical practice has become so marked that mere acquaintance with the results obtained by others should prompt a desire to employ them by all who read of their work. In a plain and conservative way this book shows what can now be done with high frequency currents in medicine and dentistry.

"Electric Power Plant Engineering." By J. Weingreen. McGraw-Hill Book Company. New York, N. Y. Cloth, 431 pages (6 by 9 inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $5.

This book should prove a useful handbook for those concerned with practical problems met with in power plant engineering. It offers to the contractor and engineer as well as the student, material which will help them understand the methods of handling electrical energy. The aim has been to restrict theoretical discussions as much as possible and to eliminate higher mathematics. The descriptions are limited to American power station engineering, and the material represents present day practice. The book is, of course, divided into two general sections, treating of direct-current and alternating-current machines and systems respectively. An interesting feature of the work is the description of typical central stations and substations, the author in every instance describing a modern and well-known plant. There are numerous illustrations and diagrams which help to simplify the text.

"Telephonology." By H. R. Van Deventer. McGraw-Hill Book Company, New York, N. Y. Cloth, 590 pages (6 by 9 inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $4.

This book presents in a practical,

non-technical manner a comprehensive description of modern telephone appliances, the erection, equipment and maintenance of telephone exchanges; a study of line, instrument and switchboard trouble and their remedies and methods of testing apparatus and cables. The subjects discussed and the order in which they are taken up are as follows: First principles, talking equipment; signalling equipment; commercial talking equipment; magneto instruments and circuits; magneto switchboards; selective and lock out systems; batteries; testing telephone parts; testing equipment and fault location; measuring instruments and their uses; common battery equipment; harmonic party line systems; line and cable construction; the automatic system; composite systems and a chapter devoted to wireless telephony. The theoretical side of telephony is avoided and the systems and apparatus in present use are treated in such a manner as to benefit the practical telephone worker. The book contains many illustrations and a number of wiring diagrams and circuits.

"The Shot-Firer's Guide." By William Maurice. Electrician Printing and Publishing Company, London, Eng. Cloth, 203 pages (5¼ by 8¼ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.50.

This manual places at the service of explosive users in mines and quarries simple, practical explanations concerning the most approved types and methods of handling blasting apparatus and the precautions that are necessary in order to secure safety. Every stage of blasting operation is described in detail; instances are given of the varieties of accident which most frequently occur and the very important question of shot-firing in fiery and dusty mines is considered in the light of the most recent inquiries. The style of the work is in the question and answer form which arrangement has been found very satisfactory. In the appendix various summaries of the results pointed out in the text are made and an interesting feature is a complete set of examination questions.

"Freight Transportation on Trolley Lines." By Chas. S. Pease. McGraw-Hill Book Company, New York, N. Y. Cloth, 62 pages (4¾ by 7¼ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

This book explains, in a comprehensive manner, how trolley lines may establish a freight traffic which bears the same relation to the passenger traffic as is the case with the steam lines. It covers the subjects of maps and statistics, routes and schedules, stations and depots, cars, tracks, employes and their instructions, and various systems of transportation in a clear and practical manner. Examples are also given of electric roads which are increasing their profits greatly by the transportation of freight.

"Handy Man's Workshop and Laboratory." Edited by A. Russell Bond. Munn & Company, New York, N. Y. Cloth, 467 pages (5½ by 8 inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $2.

This book consists of about 1,000 suggestions and ideas contributed by amateurs and professionals to the *Scientific American* recently, and classified in such a manner as to prove a valuable hand book for the mechanic and those mechanically inclined. Suggestions covering every branch of work for both household and laboratory are made.

Programme of the Paris Congress.

The following programme has been announced for the International Congress of Telephone and Telegraph Engineers, which is to meet at Paris this year:

1. Manual versus automatic systems of telephone working.

2. (*a*) Simplification of telephone circuits; (*b*) selection of frequency and secondary potential (for purposes of theoretical investigation) with a view to facilitating the approach of the telephone current to the sine wave-form; (*c*) the circumstances conditioning the adaptability of telephone apparatus to the lines, induction coils, microphone resistance, etc.

3. Precautions to be taken for the avoidance of mutual disturbance in the case of power circuits running in close proximity to telegraph and telephone lines.

4. Telephony between places at great distances from each other. Construction of cables for long-distance use, relays, combination of aerial lines with cables.

5. Wooden poles—new process for impregnation and preservation—and procedure described from actual practice as to staying and strutting.

6. Party lines and selective calling upon telegraph and telephone lines.

7. Telegraph system for heavy traffic. Multiple type-printing telegraphs and the Mereadier system.

New Subway Service in New York City.

The new subway schedule, which went into effect on the Interborough Rapid Transit Company's lines a short time ago met with marked success. Frank Healy, general manager of the company, in speaking of the new service, said:

"For the first time the complete schedule of one minute and forty-eight seconds was put into effect for both express and local service, and under such a headway we had to operate 1,904 trains, compared with 1,776 previously. Passing Ninety-sixth street up to nine o'clock the latest express train was one and one-half minutes late, for a period of two hours. In other words, we lost but one train in that time.

"At ten o'clock the Lenox avenue express service at Ninety-sixth street was four minutes late. The Broadway express service lost five minutes, or practically three trains in three hours. All local trains were on time at ten o'clock passing Ninety-sixth street, but were five minutes late on arriving at the Brooklyn bridge station.

Profit in Three-Cent Fares.

Three-cent street railway fares on the Cleveland traction system have not only proved a paying venture, but, after a month's operation, promise to give a surplus to the railway company.

The statement issued by the company covering its operations for March, or since the lighting of the receivership, shows a probable profit of .66 cents over the average car mile expense, or $13,964.24 over and above operating expenses and the six per cent return allowed the stockholders.

The disbursements have not yet been summed up by the accountants, but they are estimated at $448,570, as against earnings of $496,734.39.

Crowded Cars in Washington.

According to an opinion handed down by Justice Josiah Van Orsdel of the District Court of Appeals, no street car company in the District of Columbia is liable to prosecution for car crowding. Although a bill was passed making the overcrowding of cars an offense, it was not clearly stated what constituted overcrowding and the court held that inasmuch as the word "crowded" was not defined the jury could not inflict a penalty on the street car company.

QUESTIONS AND ANSWERS.

BONDING ON INTERURBAN ROADS.—I have noticed that the rails of the interurban road here are not joined together by copper bonds. Is it not always necessary to do this in any electric railway?—J. F., Streator, Ill.

The object of bonding the rails of an electric railway is twofold: first, to make the return circuit of the railway so perfect a conductor that current will not deviate away from the rails to adjoining water or gas pipes or other buried conductors to their detriment from electrolytic action; second, to reduce the resistance of the return circuit so that the power used in it will be reduced to a minimum. On city railway lines the first requirement practically makes bonding imperative on account of the presence of many underground pipes, cables, etc. On country lines, there being no buried underground conductors adjoining, the necessity for bonding is determined by the second requirement. If the road has a heavy traffic, the current on the line will be heavy and bonding a practical necessity. If the road has a relatively light traffic, as most interurbans run only single-car trains at intervals of half an hour or more, the line current will not be very great and the amount of energy dissipated in the return circuit not excessive, especially so if the track construction is of a substantial character. Therefore rail bonding is often not installed on new lines to save initial expense and cost of inspection and renewals. Exposed bonds are a temptation to theft and concealed bonds on open track have not yet been installed very extensively.

USE OF TWO VOLTMETERS TO INCREASE RANGE.—We have a couple of voltmeters that can read up to 300 volts and which we use for testing in the shop, where the voltage is 110 between the outside wires and the middle wire and 220 between the outside wires. One of our men was sent out to test a 550-volt railway motor and said he did it with two of the voltmeters. How was this done?—H. O. P., Toledo, Ohio.

The two voltmeters are connected in series and the set connected across the 550-volt circuit. Both instruments must be read at the same instant and the sum of the two readings is the voltage across the circuit. If both voltmeters have exactly the same resistance each will read half of this voltage; if their resistances are not alike, their readings will bear the same ratio as their resistance. This method may be extended and three such voltmeters used to measure a 750-volt circuit, etc. On a fluctuating voltage it requires as many observers as there are instruments to read them simultaneously. A simple and cheaper method of doubling the range of a voltmeter is to put in series with it a noninductive resistance exactly equal to the resistance of the voltmeter. Then there is no necessity of having more than one voltmeter or one observer.

CURRENT AND CONSTANT-CURRENT TRANSFORMERS.—Is there any difference between a current transformer and a constant-current transformer?—B. M. R., Watertown, Wis.

There is a marked difference between these two types of transformers. The current transformer is one having a fixed magnetic circuit and a fixed ratio between its primary and secondary currents. Its primary coil consists usually of a small number of turns, sometimes only a single turn, and is connected in series with a circuit whose current is to be measured by a low-reading ammeter that could not carry so large a current directly. Thus it accomplishes the same purpose that a shunt does for direct-current ammeters. Current transformers are also used to transform the current for the series coils of alternating-current wattmeters, watthourmeters, power-factor indicators, etc. They are often called series transformers. A constant current transformer is one having one of its coils movable on the iron core. It has neither a fixed ratio between its primary and secondary voltages nor between the primary and secondary currents. But it does transform a variable primary current of practically fixed voltages to a practically constant secondary current of variable voltage. Constant-current transformers are generally used for series arc-lighting-circuits, where the current should be constant.

THE PROPOSED UNIT "KELVIN."—Is there an electrical unit called a "kelvin?" What does it represent?—J. A. Y., Burlington, Iowa.

Shortly after the death of Lord Kelvin (Sir William Thomson) in December, 1907, it was proposed by a number of English electrical men to give the name "kelvin" to the unit of electrical energy commonly called the kilowatt-hour. It was urged that this name not only had the merit of brevity but would fittingly commemorate the work of the great scientist. The word kelvin has not yet been adopted to any extent in this connection, however. To secure its general use it would doubtless require the approval of an international electrical congress.

Metropolitan Street Railway Sale.

Final decree of the United States Circuit Court based on the mandate of the Circuit Court of Appeals directing sale under foreclosure proceedings of the Metropolitan Street Railway Company in default of payment of principal and interest on bonds amounting to $13,589,270, given to secure a mortgage held by the Guaranty Trust Company of New York, was filed April 7.

The decree of the court directs that this balance with six per cent interest from March, 1909, be paid in the court by the receivers of the Metropolitan Company within twenty days. If this order is not complied with, William L. Turner, who is appointed special master by the court, is directed to sell at public auction to the highest bidder on a date to be fixed by him all the property, estate, franchises, contracts and other effects owned or controlled by the Metropolitan Company in the Broadway and Seventh Avenue Line, the Fourth & Madison Avenue Railway, the Columbus & Ninth Avenue Railway, the Eighth Avenue Railway, the Forty-second Street & Grand Street Ferry Railway, the Twenty-third Street Railway, the Metropolitan Crosstown Railway, the Houston, West Street & Pavonia Ferry Railway, and the extensions of these roads, with the exception of the real estate of the Broadway & Seventh Avenue Company, the Metropolitan Crosstown Railway, the Houston, West Street & Pavonia Ferry Railway and the Columbus & Ninth Avenue Railway.

The proceeds of the sale are to be used for payment of the costs of the sale and master's charges for the payment of receivers' certificates amounting to $3,500,000 and interest, and special franchise and city taxes due. All bidders at the sale are required to deposit previous to bidding $100,000 in cash, otherwise they will not be eligible as bidders. Further particulars as to date of sale and terms will be published hereafter.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE PEERLESS ELECTRIC COMPANY, of Warren, Ohio, has been awarded the contract for furnishing incandescent lamps for the city of Niles for the coming year.

THE CONSOLIDATED ELECTRIC COMPANY, of Nashville, Tenn., secured the contract for wiring the Presbyterian Church at Bowling Green, Ky. The company also has several contracts for wiring residences and buildings in and near the city.

WHITMAN & MOUNTFORD, electrical contractors of Macon, Ga., were awarded the contract for the electrical work on the Masonic Temple at Greenville, S. C. The contract is quite extensive and there were a number of bidders. B.

THE SOUTHERN ELECTRICAL COMPANY, Thomasville, Ga., has been incorporated by J. C. Beverly and Gus Rudisill, to deal in electrical supplies. B.

SPARKS & COOKE recently began business as an electrical supply company at Thomasville, Ga. B.

JOSEPH FOWLER, Memphis, Tenn., for the past five years with Lew Tisdale & Company, has organized the Joseph Fowler Electric Company and has opened an office and warehouse at 42 North Second Street, where the company has every facility for doing all kinds of electrical work, wiring, etc. Mr. Fowler has been engaged in electrical work in Memphis for fifteen years.

THE EVANS-DICKSON COMPANY, of Tacoma, Wash., has been recently incorporated by Llewellyn Evans, of Puyallup, and David T. Dickson, of Tacoma. The capital stock is $20,000, and the company's stated purpose is to deal in electrical and mechanical equipment and to engage in supplying lighting, telegraph and telephone service.

THE E. P. SMITH ELECTRIC CONTRACT COMPANY, Dubuque, Ia., was awarded the contract for the electric wiring and fixtures for the new plant of the Armour Packing Company at Dubuque. C.

OTIS & SQUIRES, of San Francisco, Cal., have been appointed agents in California, Arizona and Nevada for the Durant Electric Company, of Chicago. The Durant company manufactures rubber-covered iron telephone drop-wire.

BACON & HANCOCK, electrical contractors of Austin, Tex., recently moved their office from 715 Congress Avenue to 909 Congress Avenue. This firm manufactures its own fixtures, making a specialty of fine glassware and art domes. The electrical contracting business in Austin has been remarkably good for the past year, as may be seen from the fact that new buildings to a value of $3,000,000 are being erected there. Further impetus will doubtless be given to the electrical business by the completion of the $1,000,000 dam and power house on the Colorado River.

South American Electrical Progress.

Recent reports from Venezuela contain information to the effect that Caracas is supplied with electric lighting from two plants, 1,000 horsepower being secured from Encantado, nine and three-fourths miles distant, and 200 horsepower from what is known as the Junin plant, which has gasoline motors for generating and is equipped with modern American machinery. A new plant is being put in at Los Naranjos on the Guaire River two miles away where it is planned to develop 1,000 horsepower by the use of the waterfalls.

There are 4,756 miles of telegraph lines in Venezuela with 169 offices. The income from the government lines is slightly over $64,000 annually. The government proposes to construct a telegraph line through the country south of the Orinoco River to San Fernando de Atabapo, a point on the headwaters of the Manoas River, near the borders of Colombia and Brazil. If possible, connection will be made with the Brazilian system and this will lead, by agreements with the Brazilian and other governments, to the formation of an international Latin-American system of telegraphs.

By a legislative decree of October 25, 1909, the President of Paraguay has granted to the National Telephone Company the privilege of importing free of duty the machinery and supplies necessary for the conservation and extension of its telephone line. By the same decree it is freed from federal and municipal taxes, and is authorized to erect such posts in the municipalities through which its wires pass or may be needed for the stringing of its wires. These concessions are for ten years.

The Chapala Hydroelectric and Irrigation Company, of Mexico City, Mexico, is planning to build a canal to Las Juntas, where it will erect a power plant for the purpose of transmitting electric power from the Santiago River in the State of Jalisco to the Aguascalientes district near Guadalajara. The Santiago River is to be tapped near the Juanacatlan Falls. It is estimated that the water of the canal at that point will be sufficient to generate about 90,000 horsepower.

The government of Brazil has granted a concession for the laying of a coastwise submarine cable and the maintenance of a cable service between Para in the northern and Chuy in the southern part of the Republic, to run for twenty-five years and for which the concessionaire is obligated to pay to the government two cents for each word transmitted in international messages. The government will be allowed a reduction of fifty per cent from the regular tariff on all official messages which it may send. The first section of the cable, between Para and Nictheroy, must be ready for operation within three years, and the entire line must be completed within nine months from that date.

The telegraph system of Bolivia comprises 3,098 miles, of which 2,390 miles are the property of the state.

The Argentine Government is considering a plan, in connection with other interested nations, for the establishment of wireless telegraphic communication between South America, Europe, Asia and Africa. The route proposed, as at present contemplated, is from Turra del Fuego, along Argentina, Uruguay and Brazil to the Fernando de Woronha, Cape Verde, and Madura Island to Gibralta, then along the Atlantic and Mediterranean coast to Asia and Northern Africa.

Record Life of an Osram Lamp.

The General Electric Company of England records the extraordinary performance of an Osram lamp which in actual use by one of the company's customers burned for no less than 15,643 hours before finally burning out. The lamp operated at its proper voltage and gave an excellent light right to the end.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

CHICAGO RAILWAYS COMPANY.

The Chicago Railways Company has issued its annual report for the year ended January 31, 1910. The actual figures compare as follows:

	1910	1909
Total earnings	$12,442,882	$11,037,071
Expenses and taxes	8,710,017	7,725,950
Balance 20 per cent of gross	3,732,864	3,311,121
Interest 5 per cent on valuation	2,275,718	1,739,684
Net income	$ 1,457,146	$ 1,571,437
City's proportion, 55 per cent	$801,430	$864,290
Company's proportion	655,715	707,147

ROCKFORD ELECTRIC.

The report of the Rockford Electric Company for the month of February and twelve months ended February 28 compares as follows:

February:	1910	1909
Gross earnings	$30,525	$26,858
Net earnings	10,834	7,801
Surplus after charges	5,287	3,390
Twelve months:		
Gross earnings	$328,922	$292,269
Net earnings	125,238	93,962
Surplus after charges	68,840	43,598

MEXICAN TELEPHONE AND TELEGRAPH.

Mexican Telephone and Telegraph Company reports for the year ended February 28, 1910 (Mexican currency):

	1910	1909
Gross earnings	$480,609	$385,767
Net earnings	251,017	181,436
Subscribers	8,861	6,943

CUMBERLAND TELEPHONE AND TELEGRAPH.

The report of the Cumberland Telephone and Telegraph Company for the month of January compares as follows:

	1910	1909
January gross	$554,904	$533,858
Expenses	317,027	305,425
January net	$237,877	$228,732
Charges and taxes	48,141	44,747
January surplus	$189,736	$183,985

ROCKY MOUNTAIN BELL TELEPHONE.

The Rocky Mountain Bell Telephone Company report for the year ended December 31, 1909, compares as follows:

	1909	1908
Gross revenue	$1,855,689	$1,628,030
Expenses	1,332,467	1,317,462
Net revenue	$ 523,222	$ 310,568
Deductions:		
Taxes	100,175	100,572
Interest charges	341,479	314,992
Total deduction	$ 441,654	$ 415,564
Surplus	81,568	104,996

*Deficit.

INDIANA UNION TRACTION.

The report of the Indiana Union Traction Company, for the year ended December 31, 1909, compares as follows:

	1909	1908
Gross	$2,103,019	$1,902,330
Operating expenses	1,113,429	1,058,745
Net	$ 989,590	$ 843,585
Fixed charges	948,756	854,249
Surplus	$ 40,834	*$ 10,664

*Deficit.

OTIS ELEVATOR COMPANY.

The annual report of the Otis Elevator Company for the twelve months ended December 31, 1909, shows net earnings, after deducting all interest and patent earnings, repairs, renewals, etc., of $1,048,689, an increase of $215,917.

Preferred dividends called for $378,600, which left a balance of $670,089, equal to 10.51 per cent earned on the common stock, against 7.12 per cent in the preceding year.

Stockholders have authorized the issue of $3,500,000 ten-year debenture five per cent convertible bonds, and have increased the capital stock from $6,500,000 to $10,000,000 to provide for conversion of the bonds. Stockholders may subscribe to the new bonds at ninety-seven and one-half.

Subjoined is the condensed income account, with changes:

	1909.	Increase.
Net earnings	$1,048,689	$215,917
Preferred dividends	378,600	225
Balance	$670,089	$215,692
Common dividend	191,259	Unchanged
Balance	$478,830	$215,692
Depreciation	362,845	149,707
Surplus	$115,985	$65,985

AMERICAN TELEPHONE AND TELEGRAPH.

The American Telephone and Telegraph Company reports earnings for January, with all duplications, including interest, dividends, and other payments to American Telephone and Telegraph Company by associated holding and operating companies, excluded, compared as follows:

	1910	1909
January gross	$13,384,795	$12,076,510
Operating expenses and taxes	4,845,356	4,578,041
Balance	$8,539,437	$7,498,469
Maintainance and depreciation	4,123,983	3,535,911
January net	$4,415,454	$3,962,558
Interest	873,870	1,029,680
January surplus	$3,541,584	$2,933,878

CENTRAL AND SOUTH AMERICAN TELEGRAPH.

The Central and South American Telegraph Company has issued its report for the year ended December 31, 1909. The income account compares as follows:

	1909	1908
Gross	$1,665,029	$1,664,506
Expenses	667,983	677,160
Net	*$997,046	$987,346
Dividends	574,260	574,260
Balance	$422,786	$413,086
Repairs and renewals	18,339	84,558
Surplus	$404,447	$328,528
Previous surplus	1,348,347	1,019,819
Profit and loss surplus	$1,752,793	$1,348,347

Equal to 9.97 per cent earned on $10,000,000 capital stock as compared with 9.87 per cent earned on same stock last year.

MICHIGAN STATE TELEPHONE.

The Michigan State Telephone Company has issued its report for the year ended December 31, 1909. The income account compares as follows:

	1909	1908
Gross	$3,819,630	$3,413,280
Expenses and taxes	2,994,379	2,501,851
Net	$ 825,251	$ 911,429
Special expenses and bond discount	.....	29,229
Net	$ 825,251	$ 882,200
Interest	443,260	417,595
Surplus	$ 381,991	$ 464,605
Dividends paid	*344,482	206,128
Surplus	$ 37,509	$ 258,477
Previous surplus	641,138	584,968
Total surplus	$ 678,647	$ 843,445
Deductions	.....	202,307
Profit and loss surplus	.....	$ 641,138

*Includes common dividend $207,510.

Surplus, after payment of six per cent dividends on the preferred stock, is equal to 4.08 per cent earned on $6,000,000 common stock as compared with 5.45 per cent earned on same stock last year.

CAPITAL TRACTION COMPANY.

The Capital Traction Company, of Washington, D. C., has issued its report for the year ended December 31, 1909. The income account compares as follows:

	1909	1908
Gross	$2,024,484	$1,831,816
Expenses	918,373	793,141
Net	$1,106,111	$1,038,669
Other income	29,294	24,164
Total income	$1,135,405	$1,062,833
Interest, taxes and renewal	293,026	290,947
Surplus	$ *842,379	$ 771,886
Dividends	720,000	720,000
Surplus	$ 122,379	$ 51,886

*Equal to 7.02 per cent earned on $12,000,000 capital stock, as compared with 6.42 per cent earned on same stock last year.

MEXICAN TELEGRAPH COMPANY.

The Mexican Telegraph Company has issued its report for the year ended December 31, 1909. The income account compares as follows:

	1909	1908
Total receipts	$ 848,597	$ 811,342
Deductions—		
Operating expenses	160,206	153,749
Rep. C. S. Mexican	9,270	.....
Sinking fund	.....	1,401
Mexican government	34,569	30,354
Sundry accounts	851	.....
Cable used in repairs	68,565	14,215
Total deductions	$ 273,461	$ 199,719
Net earnings	*575,136	611,623
Dividends	340,942	287,010
Surplus	$ 234,194	$ 324,613
Prevoous surplus	2,706,507	2,381,895
Total surplus	$2,940,701	$2,706,508
Constructing acct. expenses	717,525	.....
Net surplus	$2,223,176	$2,706,508

*Equal to 15.33 per cent earned on $3,750,000 capital stock, as compared with 20.38 per cent earned on $3,000,000 capital last year.

UNITED STATES TELEPHONE.

The United States Telephone Company reports for the year ended December 31, 1909, compared as follows:

	1909	1908
Gross	$433,081	$444,849
Net	189,610	247,302
Other increase	25,048	27,683
Interest	107,800	107,800
Surplus	106,858	167,185
Dividends	58,252	51,855
Depreciation, etc.	40 036	14,331
Surplus	8,570	100,999

NEW YORK EDISON.

The New York Public Service Commission has issued a report covering operations of the New York Edison Company for the year ended December 31, 1909, as follows:

	1909	1908
Operating revenue	$16,545,860	$15,228,716
Operating expenses, depreciation and taxes	8,552,948	9,087,680
Net operating revenue	$ 7,992,912	$ 6,141,035
Other income	7,398	1,014,436
Total income	$ 8,000,310	$ 7,155,471
Interest, rental, etc.	3,280,503	3,250,767
Net corporate income	$ 4,719,807	$ 3,904,704
Previous surplus	14,835,547	12,849,628
Total surplus	$19,555,354	$16,754,332
Dividends		2,703,060
Net surplus		$14,051,272
Profit and loss sundry additional		784,275
Profit and loss surplus		$14,835,547

EDISON ELECTRIC ILLUMINATING COMPANY.

The New York Public Service Commission has issued a report covering operations of the Edison Electric Illuminating Company of Brooklyn, for the year ended December 31, 1909, as follows:

Operating revenue	$3,670,259
Operating expenses, depreciation, taxes, etc	2,254,245
Net operating revenue	$1,416,014
Other income	2,182
Total income	$1,418,196
Interest, rentals, etc.	620,209
Surplus for year	$ 797,987

The surplus as above shown $797,987 compares with $446,559, the surplus for the previous year.

TORONTO RAILWAY COMPANY.

The Toronto Railway Company has issued its annual report for the year ended December 31, 1909. The income account compares as follows:

	1909	1908
Gross	$3,926,828	$3,610,274
Expenses	1,995,914	1,889,047
Net	$1,930,914	$1,721,226
†Charges	838,532	774,028
Surplus	*$1,092,382	$ 947,198
Dividends	560,000	379,514
Surplus	$ 532,382	$ 467,684
Contingent account	150,000	150,000
Net surplus	$ 382,382	$ 317,684

†Includes payment of city's percentage $507,827 in 1909, also paying charges, taxes, etc.
*Equal to 13.65 per cent on $8,000,000 capital stock, comparing 11.84 per cent earned on same stock last year.

SHAWINIGAN WATER AND POWER.

The Shawinigan Water and Power Company has issued its annual report for the year ended December 31, 1909. Gross earnings from all sources amounted to $819,171, against $706,244 last year. Net earnings, after operating expenses, maintenance, etc, were $701,123, against $608,884 last year. Surplus after charges amounted to $321,306, compared with $269,419 the previous year, out of which dividends of $260,000 were paid both years.

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of February and nine months ended February 28 compares with last year as follows:

	1910	1909
February gross	$ 553,543	$ 519,720
Expenses	286,728	294,858
February net	$ 266,815	$ 224,862
Charges, taxes, etc.	150,582	153,141
February surplus	$ 116,233	$ 71,721
Nine months gross	5,339,159	4,938,293
Expenses	3,007,383	2,815,049
Nine months net	$2,331,775	$2,123,244
Charges, taxes, etc.	1,415,514	1,415,276
Nine months surplus	$ 916,261	$ 707,968

KINGS COUNTY ELECTRIC LIGHT AND POWER.

The Kings County Electric Light and Power Company reports earnings for January, which compare as follows:

	1910	1909
January gross	$393,217	$350,706
Expenses	168,305	148,511
January net	$224,912	$202,195
Charges and depreciation	106,271	96,415
January surplus	$118,641	$105,780

In the month of February the output increased twenty-six per cent.

TWIN CITY LINES.

The report of the Twin City Rapid Transit Company for the month of February and two months ended February 28 compares as follows:

	1910	1909
February gross	$ 536,955	$ 483,101
Expenses	281,618	273,784
February net	$ 255,337	$ 209,317
Charges tax and preferred dividends	140,229	133,963
February surplus	$ 115,107	$ 75,354
Two months gross	1,120,917	1,008,762
Expenses	584,250	559,610
Two months net	$ 536,667	$ 449,152
Charges and tax preferred dividends	280,458	267,926
Two months surplus	$ 256,209	$ 181,226

CANADIAN WESTINGHOUSE GAIN.

The annual meeting of the Canadian Westinghouse Company, Limited, was held at its head office at Hamilton, Ontario. It was stated upon adjournment that the sales for the year were the largest in the history of the company and were about double those for the year 1908.

The annual report shows the following assets: Cash, $608,402; accounts and bills receivable, $853,233; property and plants, $2,766,488; materials and products on hand, $1,269,728. Under liabilities: Accounts payable, $275,515; reserve for depreciation and inventory, $320,000; undistributed profits, $536,103; the profits for the year ending December 31, 1909, $498,379; dividends paid for 1909 at six per cent were $261,540.

The directors of the company are: George Westinghouse, Pittsburg; H. H. Westinghouse, New York; L. A. Osborne, Pittsburg; T. Ahearn, Ottawa; Warren Y. Soper, Ottawa; Hon. J. M. Gibson, Hamilton; C. F. Sise, Montreal; Robert Mather, New York; Charles A. Terry, New York; Paul J. Myler, Hamilton.

The officers of the company are: George Westinghouse, president; H. H. Westinghouse, vice-president; L. A. Osborne, vice-president; Paul J. Myler, vice-president; John H. Kerr, secretary; and F. A. Merrick, general manager.

AMERICAN DISTRICT TELEGRAPH.

The American District Telegraph Company of New Jersey has issued its final audited statement for the year ended December 31, 1909. The comparative statement follows:

	1909	1908
Gross	$3,638,928	$3,221,727
Expenses	2,756,779	2,435,845
Net	$882,149	$785,882
Dividends	398,496	398,088
Surplus	$483,653	$387,794
Previous surplus	1,632,737	1,244,942
Profit and loss surplus	$2,116,390	$1,632,737

UNITED ELECTRIC SECURITIES COMPANY.

The United Electric Securities Company has issued its annual report for the year ended January 31, 1910, which gives gross income from investments at $367,515, and net income after expenses and interest are paid at $121,376.

Profit from sales of securities, less adjustments on collateral trust bonds amounted to $228,782, making total net income $350,159, from which deduct $195,000 paid out in dividends, leaving a surplus for the year of $155-159. The total surplus is now $1,420,222. Deduct decrease in book value of assets $105,502, making profit and loss surplus as of February 1, 1910, $1,314,719.

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of January and seven months ended January 31, compares as follows:

	1910	1909
January gross	$101,784	$ 99,637
Expenses	77,998	61,938
January net	$ 23,786	$ 37,699
Charges and taxes	31,964	28,190
January deficit	$ 8,178	*$ 9,509
Seven months' gross	959,790	880,682
Expenses	522,900	470,689
Seven months' net	$436,890	$409,993
Charges and taxes	209,539	194,667
Seven months' surplus	$227,351	$215,326

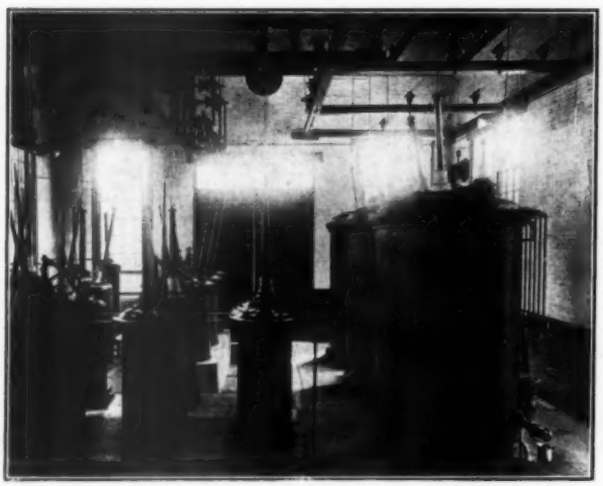
*Deficit.

INDUSTRIAL SECTION

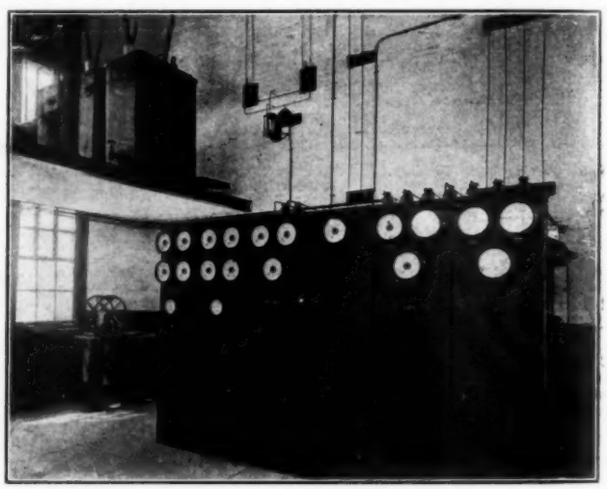
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Transmission System of the Idaho-Oregon Power Company.

The present transmission system of the Idaho-Oregon Light and Power Company, in the region surrounding Boise, Idaho, comprises two waterpower generating stations; one of 1,500 kilowatts capacity at the Horseshoe Bend of the Fayette River, and one of 900 kilowatts capacity at Barber Dam on the Boise River, six miles from the city of Boise, together with about 112 miles of high tension transmission line, approximately one-half of which operates at the transmission potential of 66,000 volts and one-half at 23,000 volts.



INTERIOR OF EMMETT SUBSTATION.



SWITCHBOARD IN SUBSTATION.

The two generating stations, above referred to, at the present time supply the principal load of the system, the lighting and traction service of the city of Boise, through 23,000-volt lines. To supply the region north and west of Boise, where, besides the local service, power is used for mining, a transformer substation has been installed at Emmett, forty-two miles from the city and sixteen miles beyond the power plant on the Horseshoe Bend line, stepping up from 23,000 to 66,000 volts through three 1000-kilowatt delta-connected Westinghouse transformers. From this station the 66,000-volt lines continue through the Plymouth and Ontario substations to the Weiser substation. Sixty-five miles northwest of this point, the Idaho-Oregon Company is building the great Oxbow hydraulic waterpower plant on the Snake River, which will make available approximately 30,000 horsepower, and will ultimately be used to supply the principal load of the system at Boise, at a transmission distance of 125 miles.

When the Oxbow station is completed and put into operation, the Horseshoe Bend and the Barber Dam plants will be operated as auxiliary generating stations.

The principal substation, both in the present plant operation and in the transmission scheme, including the new Oxbow stations, is that at Emmett. This station equipment includes three delta-connected 1,000-kilowatt transformers, stepping from 23,000 to 66,000 volts, for transforming the principal through load; and three 100-kilowatt, 66,000 to 2,300 volts, transformers, star-connected, for supplying the local distribution lines in the territory adjacent to the station.

The in-coming 66,000-volt lines from Ontario and Weiser, of stranded aluminum cable of a carrying capacity equivalent to No. 1 copper, are brought into the Emmett substation past aluminum cell, electrolytic lightning arresters, and carried through disconnecting switches to impedance coils, and thence to the 66,000-volt station bus-bars. Feeding from these, the main power load of the system is led through three Westinghouse type "GA" oil circuit-breakers to the group of 1,000-kilowatt transformers stepping down to 23,000 volts. The low tension terminals of these units are connected through Westinghouse type "E" oil circuit-breakers to the line, after passing lightning protective apparatus, in general, similar to that on the in-coming 66,000-volt lines. The second circuit taken from the 66,000-volt station bus-bars is led, through a similar set of type "GA" oil circuit-breakers, to the 100-kilowatt transformers of suitable ratio, lowering to the 2,300-volt distribution voltage. From these 2,300-volt bus-bars, the feeder circuits are controlled by Westinghouse type "B" circuit-breakers. The equipment of the other substations is quite similar in the arrangement of the distributing and feeder circuits and the apparatus involved, although the Emmett station is the only one where the main power load must be controlled at the full transmission voltage.

One of the interesting developments of the Idaho-Oregon installation has been the performance, as recorded in service, of the Westinghouse type "GA" oil circuit-breakers. On this transmission system there are now four of these three-pole units operating. Two of these are in the Emmett substation, and one in each of the Weiser and Ontario substations.

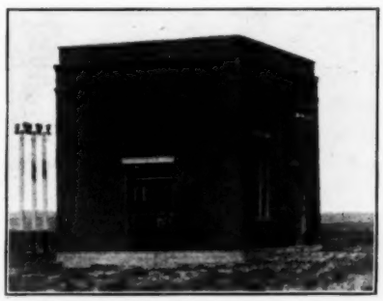
The Westinghouse type "GA" cir-

cuit-breaker is made up of single pole units immersed in oil in separate boiler steel tanks, without other connections than the operating or pull rods working the contacts. The operating system consists of a simple arrangement of levers, bell cranks and links, actuated by a toggle from the switchboard handle. The trip coils are actuated from the low tension winding of series transformers connected in the line wires. In the newer and present standard type of these circuit breakers above 100 amperes capacity, these series transformers are mounted directly over the high tension bushings of the breaker forming a part of the breaker. An accompanying illustration shows the assembly of a group of "GA" circuit breakers with this self-contained arrangement of the series transformers and also pictures very clearly the system of operating links and the tripping mechanism. The controlling force in the opening of these circuit-breakers is that of gravity, the moving parts being so positioned and proportioned that the contacts automatically drop open to produce a wide and ample break in the clean oil of the center of the tank when the mechanism is released by the handle or tripping coils. The spring socketed seats of the butt contacts also assist in producing a rapid positive break, besides assuring a self-aligning and firm closure of all of the contacts.

The leads or bushings of these circuit-breakers are of the well-known condenser terminal type brought out by the Westinghouse Company. A simple tell-tale device indicating the position of the contacts is provided by a small double pole, double throw switch operated by the controlling system which is arranged to light a red lamp on the switchboard while the circuit is closed, and a green lamp when the breaker is open.

The 66,000-volt "GA" circuit-breakers for the Idaho-Oregon system have a total break of about seventeen and one-half inches per contact, or thirty-five inches per pole. Each breaker has a rated capacity of 300 amperes, being especially designed to open the circuit under severe conditions. The small space and head room required by this apparatus especially recommends it for installations where space is limited, and the thorough insulation afforded by its oil immersed contacts in lined tanks, the internal insulating barriers and condenser terminals insure the reliability and safety of its operation in handling the heaviest overloads and short circuits. The ease with which these circuit-breakers are installed and adjusted, and the accessibility of all operating parts for examination, are also important items in gaining the favor of operating men where "GA" breakers have already been put into service.

The "GA" circuit-breakers on the lines of the Idaho-Oregon Light and Power Company have already been operated more than six months, and during this time have handled some extreme overloads and surges in a manner gratifying to the company's engineers. Several surges have occurred in which the voltage rose beyond the scale of the meters, 90,000 volts. These phenomena have been observed during heavy wind storms and when the Boise substation trips out. The Boise load is inductive and tends to neutralize the heavy capacity of the lightly loaded transmission



VIEW OF EMMETT SUBSTATION.

line. No static appears on these terminals, although at times the wiring and porcelain insulators have displayed considerable corona. The performance of these circuit-breakers has been a source of much satisfaction to the operating officials, as their operation has been uneventful and dependable under all conditions so far met during the most severe season of the year.

O. G. F. Markus is general manager of the Idaho-Oregon Light and Power Company, and W. H. Trenner is superintendent. The alternators, substation apparatus, transformers, switchboards and circuit-breakers were furnished by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

General Electric Awarded Contract.

The General Electric Company has been awarded a contract by the Navy Department for a large power plant installation at the naval proving grounds and powder factory located at Indian Head, Md.

Southern Railway to Handle Its Trains By Telephone.

The Southern Railway is putting into service one of the most modern equipments in this country for dispatching its trains by telephone. The division being equipped extends from Greensboro, N. C., to a little beyond Lynchburg, Va., comprising about 124 miles of road with thirty-six way stations.

The equipment on the Southern road is of the latest type furnished by the Western Electric Company and it employs Gill selectors. Not only are the trains handled by the telephone over this busy division, but the regular message work on the line which has heretofore always been taken care of by telegraph, is now being accomplished by means of the telephone.

Besides the train wire and the message wire, two heavy copper circuits over which they can talk even better than on the commercial long distance telephone line, the Southern road is also equipping its block wires with telephones, so that train movements from one block to the next are controlled by the tower man by word of mouth, instead of telegraphic signals.

The equipment installed is typical of the standard telephone train dispatching systems supplied by the Western Electric Company which permits of communication between any of the stations and the dispatcher or round house and block towers.

Telephone train dispatching is an issue which at present is being extensively taken up by the railroads in the South and on many of the roads extensions to this type of service are being installed as rapidly as the equipment can be obtained. The Western Electric Company reports that it is being rushed to the point of requiring more equipment to handle the railroad orders for dispatching purposes and the universal satisfaction which has been obtained from the telephone marks its entrance into a new field.

Allis-Chalmers Business Good.

While the Allis-Chalmers Company is not operating to full capacity it is employing more men at present than at any time in its history. The company over the last several years has added largely to its capacity and could take care of considerable more work.

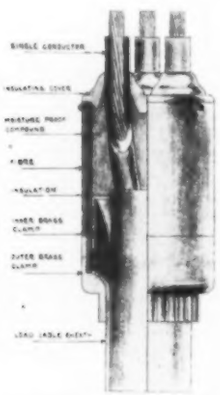
Earnings are running in excess of what they were last year, and are several times in excess of fixed charges.

New Station Pot-Head.

The materials used in the construction of the Fairmount station pot-head shown in the accompanying illustration are practically indestructible. For station work it is evident that this type of construction is practically adapted to withstand hard service without serious mechanical injury.

The combination of a metal base and insulating body and cover plate possesses all the advantages offered by both the all-porcelain and all-metal types of pot-heads. The metal base effectually forces the load sheath away from the conductors and insulating covering. This prevents the lead from being forced into the insulation and is a safeguard against careless or inefficient workmanship.

The clamping feature provides a simple and inexpensive means for making



FAIRMOUNT POT-HEAD.

a water-tight joint between the lead sheath and pot-head. This method of construction is equal to the wiped joint and has the advantage of not requiring a plumber or cable splicer.

The inside bell absolutely prevents a static discharge between cable and sheath. This point is of particular importance as numerous cable failures are traceable directly to the static discharge between the conductors and lead covering. The construction provides a perfectly smooth and circular inside face gradually diverging from the conductors and produces a uniform graduation of the static stresses induced in the cable.

The insulating cover plate and fibre body separate the single conductors and protect them from mechanical injury. The bushings in the cover plate are constructed so as to allow the insulating compound which is poured in the body of the pot-heads to flow up around the single conductors, thus materially increasing the surface breakdown distance between them.

The metal base serves as a support to the cable end and affords a perfect means of grounding the lead sheath.

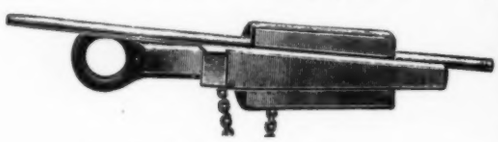
Statistics show that the largest percentage of cable failures take place at the cable end, due to the crude method generally in use for terminating the cable and separating the conductors.

One of the most important features of this pot-head is the construction of the inner clamping member, which is a continuation of the lead sheath, gradually diverging from the conductors. These pot-heads are being placed on the market by the Fairmount Electric and Manufacturing Company, Philadelphia, Pa.

The Never-Slip Wire Grip.

As the invention of practical telephone men, who have given it a thorough trial in their own exchange system before placing it on the market, the "Never-Slip" wire grip, shown in the accompanying illustration has particularly strong recommendation to the attention of telephone managers and construction men.

The construction of this grip is so



"NEVER-SLIP" WIRE GRIP.

simple that it may readly be understood from an examination of the illustration. The inventors refer to its development as arising from a practical need which they themselves experienced.

It has been observed many times that when heavy construction is under way, a number of high priced men are employed on the job while a small grip or three-bolt clamp is being arranged to make a pull, one or two of the men would be doing the work while the others would be standing around idle.

The "Never-Slip" can be adjusted in five seconds and be taken off with equally good speed. One of the principal claims for the grip is that it can be used when and wherever a great strain must be applied without damage to the wire. A groove in which the wire is inserted is four and one-half inches long. When the wire is in place a wedge-shaped tongue is adjusted between the two joints, and as the strain is applied at the opposite end from the object to be pulled, the wedge falls into the groove and pulls the tension on the wire to be pulled.

In the construction of the grip there are no rivets to strain and break, and, in fact, no joints of any kind to get out of order. The grip is made in two pieces for any size from No. 14 wire to a one-inch strand.

The demand for this grip has already reached considerable proportions and people who have used it express their hearty approval of the device.

The "Never-Slip" grip is being manufactured and placed on the market by the Union Electric Manufacturing Company, Pekin, Ill. Geo. H. Glass, president, and Geo. A. Vint, vice-president of the company, are the inventors and both are also officials of the Citizens' Telephone Company, of that city.

METHOD OF USING GRIP.

Elevated Service in New York.

The Public Service Commission of New York has adopted a final order directing the Interborough Rapid Transit Company to provide increased service on all elevated lines in Manhattan and the Bronx. The commission also adopted an order modifying its order of February 18 for increase in the service of the subway. The modified order allows a headway of two and one-half minutes during-non-rush hours.

Stockholm, Sweden, has the cheapest and most universal telephone service in the world. The cost for unlimited service is only $13.52 a year while for a limited service of 150 calls the cost is $8.11 with a charge of one and a half cents for every call above that number.

Recovering Sunken Steel With Lifting Magnets.

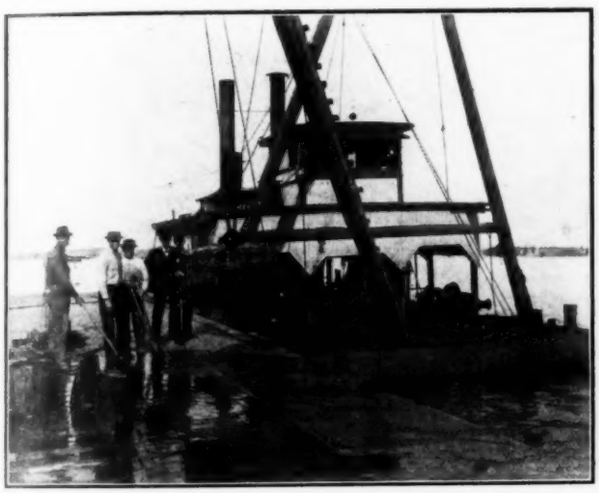
In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, March 26, 1910, there appeared a brief notice of a unique application of lifting magnets. Early in February a model barge which had been towed from Pittsburg to New Orleans, laden with 1,500 tons of wire nails in kegs, broke loose from the tug, struck the wharf and sank in thirty-five feet of water. Almost instantly the barge began slipping into deeper water and the probability of recovering the cargo became slight.

The cargo being of steel, it was thought possible to employ lifting magnets in its recovery, and although these magnets had never been used under water before, several companies were asked for bids. The feature which has heretofore forbidden the use of a magnet under water is the lack of insulating materials to keep the moisture from short-circuiting the coils in the magnet and thus rendering it useless.

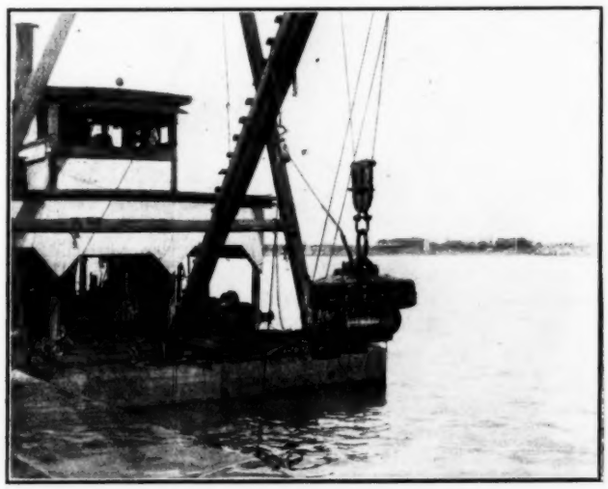
The successful bidder, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has overcome this difficulty by using a special liquid insulator which is poured into and around the coils. After the coil is wound the bottom plate of metal is screwed tight on the lower face and the cracks sealed. On the top are two holes into which are fitted pipes, one being connected to a vacuum pump and the other, fitted with a valve, is connected to the tank of insulating liquid. By means of the vacuum pump all of the air is exhausted from around the coil. The liquid is then forced into the crevices under pressure of 150 pounds. When cooled the liquid becomes hard and waterproof.

A magnet of this construction was sent to New Orleans, and the results attained indicate that there will be comparatively few losses of shipments of this character in the future. The largest haul which has been made with this magnet consisted of five kegs of nails weighing 100 pounds each, one bundle of hoops weighing seventy-nine pounds, one bundle of wire weighing 155 pounds, thus aggregating over 700 pounds. An average haul is about four kegs of nails. The two accompanying illustrations show the magnet in operation.

The success with which this method is meeting has resulted in contracts being signed for the recovery of cargos sunken near Natchez and Pittsburg.



CUTLER-HAMMER LIFTING MAGNET SALVAGING A CARGO OF NAILS.



VIEW SHOWING LIFTING MAGNET WHEN LEAVING THE WATER.

Some Recent Applications of Ozone.

Although ozone has now been definitely known for nearly seventy years, its commercial production and exploitation is one of the many by-products that have resulted from the modern development of electrical engineering, says *Nature*, London, Eng. The Ozonair Company, of 96 Victoria Street, Westminster, London, S. W., Eng., has taken advantage of these developments to produce a series of compact and (in many cases) portable ozonizers which can be connected directly to the ordinary lighting circuits and set in operation by means of a couple of tumbler switches, one controlling a fan or blower, and the other a coil or transformer for energizing the aluminum gauze in contact with which the ozone is produced. The simplicity of these arrangements should prove an important factor in securing the general utilization of ozone in all those cases in which its usefulness has been conclusively demonstrated.

Most of the new designs are intended for the purification of air, and in the case of large buildings their utility and efficiency can scarcely be doubted. In a small room or in close proximity to a generator, the presence of an excess of ozone might well be disagreeable, as those who have worked with it have good reason to know, but in a crowded hall the atmosphere of a public meeting would stand to gain enormously by the freshening and purifying effects of one or two well-placed ozonizers. In cases such as the above it is difficult, and in many buildings impossible, during the winter to introduce enough air from outside to prevent the atmosphere from becoming "stuffy," but the most dangerous and unpleasant effects might well be got rid of by means of ozone.

This general idea has been worked out into a definite and novel scheme of ventilation, which is acquiring considerable popularity in Russia, where warmth and freshness have usually presented themselves as alternatives rather than as compatible qualities, and in the tropics, where the introduction of large volumes of air from the outside is sufficient to destroy whatever remnants of coolness may be retained by the use of verandas and other devices for excluding the glare of the sun. In each of these widely dif-

fering circumstances the method used is to withdraw air from the room, purify it by screening, washing, and ozonizing, cool or warm as the case may be, and return it to the room with a sufficient admixture of outside air to keep the proportion of carbon dioxide within reasonable limits. In this way a great economy of heating or cooling is achieved, whilst the wholesomeness of the atmosphere is fully maintained.

The sterilization of air by means of ozone has found a widespread application in brewing, where it replaces with great advantage the cumbrous and only partially effective systems of air filtration that have been employed to protect the wort during fermentation, cooling, refrigerating, and bottling; it is also of service in protecting the yeast from contamination whilst it is being drained off from the wort.

An application of ozone of a more familiar type is in the bleaching of palm oil for soap making. This has usually been effected by means of bichromate and muriatic acid at a cost which may amount to as much as $7.50 per ton. The bleaching of the oil by ozone is very effective, even in the case of specially bad samples, and costs little more than a tenth of this sum; in addition, the dark sediment that is thrown out during purification is much smaller in bulk, and the waste of oil is therefore greatly reduced.

It is claimed that the ozonized air produced by the new types of apparatus is entirely free from oxides of nitrogen, a point of considerable importance in many of its commercial applications.

Westinghouse Gas Producer Plants for the South.

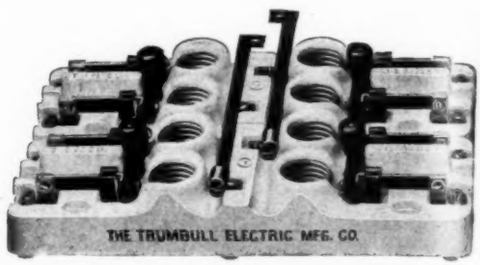
At Bennettsville, Ga., the Southern Cotton Oil Company has installed a 200-horsepower Westinghouse gas producer plant, and at Greenwood, S. C., the same company is building a similar power station for its local factory there.

This equipment is additional to 1,000 horsepower in gas producers and engines recently installed at its Montgomery, Ala., plant. The Bennettsville equipment consists of a Westinghouse type T-35 bituminous producer and a sixteen by eighteen-inch three-cylinder gas engine. At the Greenwood factory a fifteen by fourteen-inch three-cylinder engine is served by a Westinghouse producer. At the Montgomery plant, two type T-50 Westinghouse bituminous producers supply power gas for gas engines totaling over 900 horsepower. In all these factories the gas engines are belted to line shaftings through which the power transmission is made to the machinery in the mill buildings.

Cutout Bus Bars and Lugs.

The Trumbull Electric Manufacturing Company, Plainville, Conn., announces that it is placing on the market an all copper strap or bus bar and copper lugs, which can be used in connection with its panel or plug cutouts by connecting them in series, which is a great improvement over the old method of skinning wires under fastening clamps and they present a much neater appearance.

LUG. BUS BAR.



CUTOUT EQUIPPED WITH BUS BAR AND LUGS.

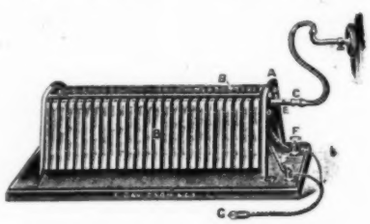
The use of these bus bars saves much time, and presents a much neater appearance. They are all copper, rated to carry fifteen amperes on a basis of 1,000 amperes per square inch of copper, and for a greater carrying capacity, can be easily laminated by placing one on top of the other.

The lugs, also of copper, can be adjusted to fit different sizes of wire. The Underwriters demand lugs and terminals above thirty amperes on which connecting wires must be soldered.

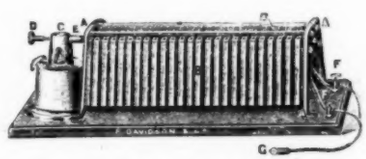
The accompanying cuts illustrate bus bar and lug, and show the method in which they are used in connecting panel cutouts in series.

The Thermo-Generator.

In the accompanying illustrations are shown two types of thermo-generators which, according to a recent issue of the *Electrical Times* (London, Eng.) are receiving considerable attention. The gas thermo-generator consists of a number of thermo-piles, the elements used being principally copper and bismuth-antimony alloy. These units are arranged over a long tube carrying the gas, and a small jet plays upon each contact. After the contacts have been warmed up the amount of gas required is extremely small, so small that it is difficult to measure. A pattern suitable for burning spirit is shown in one of the accompanying illustrations.



THERMO-GENERATOR FOR GAS.



THERMO-GENERATOR FOR SPIRIT.

The internal resistance of the thermo-generator is 0.9 ohm, and its electro motive force four volts. For charging small accumulators and other small purposes such a device is extremely useful. The thermo-generator is manufactured by F. Davidson & Company, London, Eng.

Examination for Engineer in Forest Service.

The United States Civil Service Commission announces that an examination will be held on May 4, to secure eligibles for two positions as laboratory aid and engineer in the Forest Products Laboratory at Madison, Wis. The examination will include the subjects of arithmetic, operation and care of steam pumps and also experience; which will be judged from the applicant's application.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence)

LONDON, APRIL 2.—On many occasions the strong efforts which are being made by central station engineers to develop heating and cooking loads have been mentioned.

In most cases these have taken the form of new tariffs, although in some instances, ingenuity in advertising the advantages of electricity in this connection, is made use of as important factor. Quite a new departure, however, is being made at Southampton, where the general manager of the Municipal Electrical Works argues that if it can be said to pay to supply energy for power purposes at less than two cents per unit, why not supply at equally cheap rates for domestic supply? He consequently has made the bold recommendation which has been adopted by his Council, that current for heating and cooking purposes should be supplied at three cents per unit, on a flat rate. At the present excessive prices of heating and cooking apparatus, however, it is doubtful whether even this low rate will have the desired effect.

The Tramways and Light Railways Association will hold their conference this year in Dublin.

The half yearly report of the Underground Electric Railway Company of London, with which the late Mr. C. T. Yerkes was so closely identified, makes very satisfactory reading. The company merely operates the Lots' Road generating station, which supplies current to the District railway and a number of tube railways, but it also guarantees interest in a large quantity of bonds. After meeting all its liabilities in this respect there is a profit of about $2,500. The report states the directors believe that the $800,000 due by the estate of the late Mr. C. T. Yerkes in respect to unpaid calls, will be paid in full, the greater part within the coming year, with interest at the rate of five per cent per annum.

With the completion of the reconstruction of the Highgate Hill (London) cable tramway for electric traction, the City of Edinburgh now has the only system of cable tramways in the United Kingdom. The Highgate Hill line is, all the way, on a very severe gradient, and smaller cars have been adopted, in conjunction with a very powerful track brake which grips the conduit slot on both sides. The line is a comparatively short one and at present is being worked as a shuttle line.

Some uncertainty still exists as to the general attitude of British metal filament lamp makers towards the price cutting inaugurated on the continent and reflected by the agents here of Continental firms. A few firms have reduced, but the British makers as a whole have not come into line, and it is doubtful if they will. Slight reductions have been made in the price of osram lamps, due chiefly to improvements in manufacture than to any desire to "cut" prices, and the same may be said of the British Thomas-Houston Company. I believe a meeting was held to arrive at some general action, but no decision was arrived at. G.

CONTINENTAL EUROPE.

(Special Correspondence)

PARIS, APRIL 1, 1910.—In France the Southern Railroad Company is taking measures to use the electric system upon the Toulouse-Bayonne railroad line. The first part of the line to be changed over will be the section lying between Pau and Montrejean of sixty-five miles length. It is intended later on to equip the entire line, however, which will give about 200 miles of electric railroad. The company is taking active measures to fit out the first mentioned section, and has already placed an order for the rolling stock with the Havre factories of the Westinghouse Electric Company. This includes thirty motor cars of the double truck type, containing four 125 horsepower motors. The electric line is to be run on the single-phase system, using 300 volts and fifteen cycles. The motor cars will take 100-ton passenger trains, and for the freight trains the company is to use an electric locomotive containing two 600 horsepower motors.

A hydraulic plant combined with an extensive carbide works is located at Gampel in the Rhone valley, and at present it is one of the largest in the Swiss region. Power is obtained from the mountain torrent of the Lonza, which flows into the Rhone near this point. About 8000 horsepower is now being employed for carbide manufacture, together with the current supply which is used by the Lötschberg tunnel plant during the work of drilling. The south end of the tunnel comes out at a point which lies much higher up on the same stream, and there is a second hydraulic plant situated midway between the carbide works and the tunnel which also furnishes current for this latter. For carbide and the other chemical industries there are extensive plants now in operation in the neighboring region, such as the factory located at Viege and two electro-chemical works at Martigny, all of which are operated by hydraulic power.

Electric traction is to be used on the Mori-Arco-Riva railroad line in Austria, and at the same time the road will be changed over from narrow gauge to standard gauge and will be otherwise improved. A branch line will also be run from Mori as far as the town of Rovereto and a tunnel will be built through the Nazo Pass.

Traffic has now been resumed upon practically all the sections of the Paris railway which suffered from the recent flood. The portion of the tunnel lying in the neighborhood of the Seine were all more or less filled with water and it took a considerable time to set matters to rights.

In Italy there is a great project on foot for an electric line which is to run between Torreglia and Albano. There is already an interurban electric road in operation between Padua and Albano and the new section will be an extension of this latter.

Blida, near Algiers, is to be supplied with current from a turbine plant. Measures are now being taken by the municipality to erect the station, which will use the power of the Oved el Kebir. It is expected to begin the hydraulic work within six months.

An electric tramway will be installed in the town of Breda, Holland, according to the present project, and the rights for building and operating the plant will be granted to Presse et Cie. A. DE C.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEXICO, APRIL 11.—The Compania de Tranvias de Mexico, which operates the street railway system in this city and to many points in the Federal District, is making exetnsive improvements in the matter of building new lines and bringing the physical condition of the existing property up to a higher standard. It is stated by Harro Harrsen, general manager of the company, that its new line to the suburban town of Xochimilco will be finished and placed in regular operation about the middle of May. It is from the vicinity of Xochimilco that the city is preparing to obtain its new water supply. It is a thriving town and a heavy passenger traffic over the line is assured. The construction of this line involves the building of a bridge at Teotapam. It is announced at the local office of the Mexican Telegraph and Telephone company in this city that the proceeds from the sale of $200,000 of bonds that was recently made in Boston will be used to make improvements to the system here. A new branch exchange will be established and the wires leading to it must be placed underground. It is stated that the company had an increase of 1,516 in local telephone subscribers during the fiscal year that ended February 28, 1910. The net increase in subscribers during the previous fiscal year was 1,011.

The electric transmission line of the Chapala Hydroelectric and Irrigation Company of Guadalajara will be extended to the Ameca mining district from Etzatlan, to which latter place the line is now being constructed. The demand for electric power for operating the machinery of the mines and reduction mills in the more remote parts of the state of Jalisco is growing rapidly and the company at Guadalajara is making an effort to extend its transmission lines to these places. It is announced the larger mining companies of the Ameca district have offered $125 per horsepower per annum and that this rate will probably be agreed upon by the parties concerned. It will be the latter part of the year before the new service is established.

The Ferrocarril Electrico of Torreon, which operates an interurban electric line between Torreon and Lerdo via the town of Gomez Palacio, a distance of eleven miles, and also local systems in the two terminal towns, has adopted plans for the immediate construction of a new air line which will shorten the distance between Torreon and Lerdo to seven miles. It is announced that the existing line will continue to be operated. The route of the proposed new line is through a rich agricultural section that is in a high state of development. It will follow the valley of the Nazas River all the way. This valley is noted for its great richness and it is here that most of the cotton in Mexico is produced. The three towns of Torreon, Lerdo and Gomez Palacio have a combined population of about 75,000 people and contain many large manufacturing plants. A syndicate of wealthy Chinese also own an electric street railway system in Torreon which is also to be extended.

The first electric steel converter to be installed in Mexico has arrived at Mexico City and will be placed in the Delicias rolling mills, owned by Richard Honey. Preparations are being made by Mr. Honey to install several modern new furnaces at this plant. Each will be of twenty-ton capacity. The rollers now in use will be placed in the soft iron department. D.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

WASHINGTON COMPANY WILL BUILD POWER PLANT.—The Washington Water Power Company will probably spend $1,000,000 in the development of a 40,000 horsepower plant at the Spokane Falls of the Spokane River. The company has two plans under consideration, one of them calling for the sinking of a shaft from the crest of the upper falls to bedrock in the river, a depth of 135 feet, and connecting with a tunnel to the Post-street plant. The second plan is to construct a pipe line from the upper falls to the converting plant and erect a dam at the beginning of the falls. Both projects will drain the stream for a distance of five blocks in the heart of the businesss district. David L. Huntington, president of the company, announces that engineers have been working on the plans for some time. Mr. Huntington says it is not anticipated there will be any difficulty in securing the water rights to use the power in this manner.

SECOND POWER DAM FOR THE ESCANABA.—The Escanaba Traction Company's plans for a dam on the Escanaba River are progressing rapidly and it is expected that the construction work will be under way by June 1. The dam will be located at Groos, near the Bichler quarry, and it will have a thirty-foot head of water. This will be sufficient to develop 2,000 horse power—nearly double the power developed at the Flat Rock dam, from which the company is now getting its current. The dam will be located a half mile above the power house, and the water will pass through a big steel flume. The Escanaba Traction company will have use for all the additional power that will be developed. The company is now supplying electrical current for its own railway system and also the current for lighting Escanaba and Gladstone. The first of May the interurban line between the two cities will go into commission. In addition to this the power current is supplied to many private consumers. The Flat Rock dam cannot furnish sufficient power to meet the demands, and for some time it has been necessary to operate the company's steam power plant at Escanaba, as well as the city power plant, which the company has under lease, for a portion of the time each day.

LIGHTING AND POWER.

(Special Correspondence.)

HURON, S. D.—A five-year franchise has been granted to the Huron Light and Power Company to install a lighting plant. C.

OWATONNA, MINN.—F. J. Millar, engineer, St. Paul, estimates the cost of installing a suitable municipal lighting plant at $60,000. C.

DOWNS, KAN.—The electric light plant, formerly owned by a stock company, has been sold to C. A. Brekford, of Lexington, Mo.

MILNOR, N. D.—The Milnor Auto and Electric Company proposes to install an electric light plant with a 500 or 1,000-light dynamo. C.

OAKLAND, CAL.—The Central Oakland Light and Power Company has been granted permission to lay conduits in the streets of this city.

CENTERVILLE, IOWA.—The Centerville Light and Power Company has commenced the installation of new machinery at its power house. C.

SIOUX FALLS, S. D.—The Sioux Falls Light and Power Company will expend $100,000 duplicating its present water power plant with a steam power plant. C.

BALTIMORE, MD.—The Consolidated Gas Company has installed new arc lamps in Calvert Street. This street is now one of the best lighted in the city.

SEATTLE, WASH.—The Bothell Eletric Company, with a capital stock of $25,000 has been incorporated by C. W. Kimball, W. A. Garlick and A. R. Rutherford.

ANOKA, MINN.—Oscar Claussen, engineer, St. Paul, Minn., estimates the cost of a dam in the Rum River for the municipal light and power plant at $110,000. C.

PORTLAND, ORE.—The Central Oregon Water Power Company has been incorporated here with a capital stock of $500,000 by H. F. Chapin, A. G. Hill and N. B. Chapman. A.

LOS ANGELES, CAL.—A petition has been filed with the City Council asking that an ornamental street lighting system be installed on Seventh street from Boule avenue to Hoover street.

LITTLE ROCK, ARK.—Contracts for the erection of a new electric light plant have been signed and actual work will probably begin in a short time. The plant will be of 1,000 light capacity.

OCAMPO, MEXICO.—The Sierra Consolidated Mines Company is about to build an electric power plant in Ocampo, with the intention of transmitting power to the mines and mills near this place. A.

CHICKASHA, OKLA.—R. M. Evans has closed a contract with the city of Hydro for installing a $25,000 electric light system in that city. It will be a municipal plant, bonds having been voted for it.

STERLING, NEB.—The village board of Sterling has granted a franchise for an electric lighting plant to the Drummond Electric Company of Lincoln. Work on the proposed new plant will begin at once.

WILMINGTON, DEL.—The Mississippi River Power Company, with a capital of $3,000,000, has been incorporated by J. J. Loughlin, Brooklyn, N. Y.; J. F. Carroll, New York city, and H. W. Davis, Wilmington.

LONG BEACH, CAL.—Work on the California Edison Company's power plant will commence within thirty days. The cost of the plant will be about $2,000,000 and the capacity 135,000 horsepower. A.

CAMDEN, N, J.—The Atlantic City Lighting Company has been incorporated to operate electric light works, with a capital of $125,000. The incorporators are: W. B. McDonald, G. W. Chandler and H. L. Chew, Camden.

KOKOMO, IND.—The Globe Stove and Range Company of this city is constructing a new factory building and propose installing in the basement motors, blowers and considerable electrical equipment for various purposes. S.

BAKERSFIELD, CAL.—The Huson Electric Company, with a capital stock of $75,000 has been incorporated by J. B. Murdock, J. W. Ragesidale, C. C. Painter, R. E. Woods, H. E. Smith, J. A. Felter and A. A. McCumber.

SHEBOYGAN, WIS.—The Badger State Tanning Company is to install a 300 horsepower generator at its plant, and is now changing the power from a steam driven system to an electric system with electric motors. M.

SEATTLE, WASH.—The Seattle Lighting Company has secured a permit to build a one-story brick building to cost $12,000. The building, which is to be started at once, will be located at 4490 California Avenue, West Seattle.

SULLIVAN, IND.—The Alliance Coal Mining Company has decided to equip its several mines with electric haulage, electric lights and telephones. This work will be done as soon as the material and equipment can be purchased. S.

OBION, TENN.—At an election held here a short time ago the voters of Obion ratified the proposition of issuing $55,000 of bonds, of which $30,000 was for the purchase of the electric light plant and the installation of a waterworks system.

GRANGEVILLE, IDA.—The City Council has granted Walter Hovey Hill, who owns a power site on the Clearwater River, a thirty-year power and light franchise. Work on the construction of a $100,000 power plant will begin at once.

NIAGARA FALLS, N. Y.—The Hydraulic Power Company of Niagara Falls has been incorporated to deal in water-power and real estate. The capital is $500,000, and the incorporators are: G. B. Mathews, W. D. Olmstead and P. A. Schoellkopf, Buffalo.

LOS ANGELES, CAL.—Two 12,000 kilowatt Curtis turbine generating sets have been contracted for and are to be added to the present equipment of the Redondo beach power plant. It is expected that the new machinery will be in operation by November 1.

MUNCIE, IND.—The Rutherford Brothers have ordered plans for the construction of a plant to manufacture lighting fixtures and electric supplies. The plant will be equipped for electric motor drive with a view of purchasing electricity to operate the plant. S.

PROVO, UTAH.—The Waterworks and Electric Lighting Committee of the City Council has recommended that an election be called to vote on a proposition of issuing bonds to the amount of $220,000 for building electric lighting and water works for the city. A.

SAN BERNARDINO, CAL.—In addition to building a $600,000 power house at Slide Lake, the Southern California Edison Company is hauling many tons of cement into Santa Ana canyon, for repairs on the flumes and power houses damaged by the storms of the late fall.

LAFAYETTE, GA.—A bond election to raise $28,000 for water and $12,000 in bonds for a municipal electric lighting plant, resulted in a vote of eleven to one in favor of the $40,000 bonds. Lafayette has a population of about 2,500 at the present time, and is progressing rapidly. L.

LEWISTOWN, MONT.—An electric light franchise has been granted to John L. Bright for a period of twenty-five years. Mr. Bright will pay to the city annually one and one-half per cent of the gross earnings. A dam and plant will be built at Spring Creek a short distance from town.

WEISER, IDAHO.—The Council Mesa Orchard Company, composed of Eastern capitalists, is planning an electric power house on the middle fork of the Weiser River. Power will be transmitted a distance of twenty-five miles to a connection with the Pacific and Idaho Northern at Goodrich. A.

MUNCIE, IND.—The officials of the Muncie Gear Works Company recently incorporated with a capital of $250,000 will build a large factory plant and announce that they will install therein considerable electrical machinery and equipment. H. L. Warner, D. O. Skillen and G. H. Guthrie are directors.

GRANGEVILLE, IDAHO.—The city council has granted to Walter Hovey Hill a thirty-year franchise for an electric light and power system in Grangeville. Work on the power plant, which will be situated on the South Fork, about five miles from Grangeville, will commence in a short time.

DENVER, COL.—The Central Colorado Power Company announces that its big plant in Boulder canon will be ready for operation by July 1. This plant is practically a duplicate of the Shoshone plant and the transmission lines will be so connected that there can be no failure of the company at any time to supply continuous power.

ADIN, CAL.—R. Perrault has filed on 5,000 inches of the water of Ash Creek, running from Ash Valley, in Lassen County to Big Valley in Modoc County. There is a fall of approximately 600 feet in about ten miles. A pipe line will be laid for electric power purposes, the power to be used at the Hayden Hill Mines, about six miles distant.

INDIANAPOLIS, IND.—With the permission of the city the merchants of Circle Street and Monument Place are soon to install sixteen arches, each bearing forty incandescent lights around the thoroughfare, one arch to be placed at each of the four street intersections. Robert E. Gregg and Hubert H. Keller have the matter in charge. S.

PORT ANGELES, WASH.—The Olympic Power and Electric Company, with a capital stock of $1,000,000, has been incorporated by Geo. A. Glines and Thos. Aldwell. The company has been formed for the purpose of developing the power on the Elwah River. Engineer E. V. Cummings will have charge of the engineering and development work. A.

HOOD RIVER, ORE.—A petition signed by fifty of the leading citizens of Hood River has been presented to the city council asking it to call a special election to vote on the question of buying the water system of the Hood River Electric Light, Power and Water Company. An offer from the company to sell the plant for $40,000 accompanied the petition.

CORNING, ARK.—The Southern Ice and Power Company of Corning, has filed articles of incorporation with the secretary of state. The capital stock is placed at $10,000, of which $5,000 has been subscribed. The incorporators are: George A. Booser, president; W. D. Polk, vice-president; W. W. Henry, secretary and treasurer; W. R. Brown and L. Beashers.

VERGEL, STATE OF OAXACA, MEXICO.—The Teziutlan Copper Mining and Smelting Company has obtained a concession from the federal government for the erection of a hydroelectric plant on the Sola River near here. The proposed plant will have a capacity of 1,400 horsepower which will be used to operate the machinery of the mines and mill of the company. D.

TRINIDAD, COLO.—Following reorganization of the Colorado Railway, Light and Power Company, much extension work has been started. President Frank Read has placed an order for a 5,000 kilowatt turbine engine and condenser, and another for thirty miles of copper wire to be used in extending the power line from Aguilar to Walsenburg. The company is building a new boiler house.

BERKELEY, CAL.—The municipal plant proposed by the city council is meeting with general favor among the residents of the city. At a special meeting of the North Berkeley Improvement Club held recently the proposed electric light plant was the principal topic of discussion, and the improvers were of the opinion that the council should take steps to secure such a system within the shortest possible time.

WAYNETOWN, IND.—The Waynetown Electric Light Company has filed articles of incorporation with the Secretary of State. The new company is capitalized at $10,000 and proposes to construct, equip and operate a plant for the manufacture and sale of electricity for light and power purposes to the citizens of Waynetown and Montgomery County. The directors are Thomas Lewellen, W. L. Smith and Samuel C. Rowland. S.

COAL CITY, ILL.—The Economy Light and Power Company, of Joliet, has made an offer of $16,400 for the electric light plant in the city. They base their price on two years' earnings of the plant. Last year the income from the plant was $8,200. They propose to furnish power to the village arc lamps at $65 per lamp a year, and household and business places will be supplied with meters and pay for power used at the rate of thirteen cents per kilowatt.

BODIE, CAL.—W. H. Metson and associates will install the 1,500-kilowatt, three-phase generator recently purchased from the Allis-Chalmers Company in a new power house near this place instead of on the Nevada-California Power Company's property near Bishop Creek. The generator will be direct connected to a turbine water wheel operating under a head of 350 feet. The current developed will be transmitted to this place and to mines in Nevada. A.

CHICO, CAL.—The Great Western Power Company has postponed the construction of its storage reservoir in Big Meadows, in favor of first developing its three sites along the North Fork of the Feather River above Big Bend. A. B. Bidwell, superintendent of the Great Western Power Company, states that his company will now take up the matter of establishing permanent headquarters at Big Meadows, the temporary headquarters having hitherto been at Bunnell's place near Pratville.

WAYCROSS, GA.—The Ware County Light and Power Company has awarded the contract to the Evans Company, of Baltimore, for the erection of a power house near here, fifty by eighty-one feet; and for a gas plant, work to be started within a few days and to be finished within sixty days. This contract is said to be the beginning of the extensive improvements to be carried out by the Loomis syndicate, which will expend at least $500,000, to be placed within two years from date. L.

ROCKY FORD, GA.—The Ogeechee River Electric Power Company is getting ready, it is stated, to develop its waterpower on the Ogeechee River at Rocky Ford and Oliver as the riparian rights have now been granted to it by both the Bulloch and Screven counties. D. G. Zeigler, Jacksonville, Fla., who is interested in the project, is quoted as stating that work on the plants will begin in ninety days, that $700,000 will be expended and that 11,000 horsepower will be electrically developed. This company's headquarters are in Savannah, Ga.

SAN BERNARDINO, CAL.—The Southern California Edison Power Company is planning to construct an immense power plant at Slide Lake, on Bear Creek. It is estimated that the expense in connection with this new plant will reach $600,000. The plant will supply electric energy for the entire San Bernardino valley, thus relieving the demands upon the big plants on Kern River. The company proposes to divert its water supply for the new power plant from Filaree Flats, where the New Bear Valley Mutual Water Company plans to impound the water.

CHARLOTTE, N. C.—The application of the Charlotte Power Company for a franchise gratis, to operate in this city, is developing into a more widely discussed proposition than was ever dreamed of in the beginning. The company, which is a subsidiary concern of the Southern Power Company, asks for a free franchise in accordance with the entire former policy of Charlotte, but some of the city officials are disposed to give the measure a more difficult road to travel than any of its predecessors, and the question is becoming one of wide interest. The immense industrial benefits of the company strongly argue for it however. L.

SALT LAKE CITY, U.—The Light & Railway Company's electrical construction department has begun the erection of forty-three towers between Devil's Gate and the main transmission line between Ogden and Salt Lake, 4.1 miles. These towers are being located 600 feet apart, to carry the high voltage lines transmitting 4,000-horsepower, as well as telephone wires. The towers were made by Milliken & Company, of New York, and the value of the improvement is put at $20,500. The new power plant going up at Devil's Gate will supply the power, the entire plant to be ready early in May. It will represent an outlay of $350,000.

GALT, ONT.—A special meeting of the council recently received the report of the special committee, which suggested that on the expert advice of Mr. Ross the town pay $32,000 for the electrical equipment at the local station. It was suggested that no action be taken, but the proposal was voted down. A motion was then passed that an offer be made the Galt Gas and Electric Light Company, Limited, of $16,500 for their poles and wires, and that they be given a week to accept the offer. If the offer was not accepted the council gave the committee power to go ahead and prepare plans to install a plant for the reception of hydroelectric power.

PACHUCA, MEXICO.—The new transmission line which the Mexican Light and Power Company is constructing to Pachuca branches off from the Necaxa-Mexico City transmission line at a point about seven miles from Tulancingo and will run from that point direct to Pachuca. It will consist of two circuits of three copper cables each. Steel towers upon which the cables will be placed are now being erected. In addition to furnishing power for a number of mines in the Pachuca district the company will also furnish the Compania de Luz y Fuerza of Tulancingo, state of Hidalgo, with power to augment its present service in that town and district. D.

SOUTH BEND, WASH.—The Kleeb Lumber Company is building a new mill here which is designed along the lines of the latest practice in this industry and which will have electric motor drive throughout. Allis-Chalmers Company is furnishing the power equipment which will include a 500-kilowatt, sixty-cycle, three-phase, 480-volt, alternating-current, steam turbo generator, a surface condenser for maintaining the vacuum, a fifteen-kilowatt, 120-volt motor generator exciter set, a three-panel switchboard with the necessary controlling apparatus and twenty-two induction motors ranging from five horsepower to 200 horsepower for driving the machinery about the mill.

LOS ANGELES, CAL.—The San Joaquin Light and Power Company, a subsidiary of Huntington's Pacific Light and Power Company of this city has announced that it will at once begin the expenditure of $1,250,000 on a plant on the north fork of the San Joaquin, near Fresno, where for several weeks a minor plant has been in operation. The larger plant will develop 22,000 horsepower and supply light and energy to Fresno, Fowler, Hanford, Selma and as far south as Coalings and the adjacent oil fields. The immediate work involves the construction of a dam 125 feet high, behind which will form a lake sixteen miles in circumference and an unfailing water supply to run the turbines. During the next three years the Huntington corporation will spend it is claimed, $5,000,000 in the SanJoaquin region alone.

ELECTRIC RAILWAYS.

(Special Correspondence.)

VIRGINIA, MINN.—A street car franchise was granted to E. M. and W. M. Prindle. C.

OAKLAND, CAL.—The opening of bids on the electric railway franchise applied for by the Peninsular Railway Company has been postponed to May 2.

DES MOINES, IOWA.—It is expected that work on the construction of the Des Moines and Sioux City interurban will be commenced within two months. C.

CHILLICOTHE, O.—The survey between Sunbury and Freeburg has been finished and it is probable that construction work will be started in the near future.

BELLINGHAM, WASH.—The Stone and Webster interests will shortly commence the construction of an interurban road, thirty-five miles south through the Skagit valley. C.

MISSOULA, MONT.—W. H. Smead is projecting the construction of a trolley line, about seventy-five miles long, to Polson, Mont., estimated to cost $25,000 to $30,000 a mile. C.

BOZEMAN, MONT.—The Gallatin Valley Electric Railway Company will extend its line from Bozeman Hot Springs to Three Forks, a distance of twenty-seven miles, at a cost of $50,000. C.

FRESNO, CAL.—Sealed bids will be received by the Board of Supervisors on April 23 for an electric railway franchise along certain roads of this county as applied for by the Fresno Traction Company of Fresno. A.

FRESNO, CAL.—Work on the Lemoore-Coalinga power line will be finished in a very short time, and the current will be turned on. The announcement was made by manager A. G. Wishon of the San Joaquin Light and Power Company.

ATLANTA, GA.—Preliminaries being disposed of, work on the construction of the interurban Atlanta and Macon electric railway will be begun shortly, the new line cutting off considerable mileage, the distance from here to Macon by the electric line being eighty-eight miles. Right-of-way has been secured over the entire distance. L.

GUTHRIE, OKLA.—It is announced that the purpose of the Ardmore and Western Railway Company is to build an extensive system of railways. The company has a capital of $100,000 and was chartered by Oscar Ayres, J. A. Bixens, J. R. Pennington, U. S. Jones and R. A. Heffner of Ardmore, and Emery S. Ayres of Edgerton

GRIFFIN, GA.—The contemplated electric line to Indian Springs is said now to be fully assured, the promoters being W. F. Smith, of Flovilla, Ga., and L. W. Roberts, of Atlanta. The company has applied to the railroad commission for the privilege of issuing $1,500,000 bonds and $200,000 stock. The line will probably be extended on to Social Circle, Ga. L.

THE DALLES, ORE.—The ordinance granting a thirty-year franchise for a street railway line, asked for by E. W. Thomas, a Philadelphia capitalist, has been passed by the council. The line will extend below and above the bluff, and will turn southeast to the Dry Hollow district and southwest out Mill Creek way, and is to be in operation within two years.

BOLIVAR, MD.—Mr. Patterson of Baltimore, Md., vice president of the Bolivar-Wellsville Construction Company, is making preparations for the building of the proposed trolley line between Bolivar and Wellsville. The line will be about nineteen miles long, and will cost $10,000 a mile to build and equip. The company expects to have the road ready for operation in 1911.

PALESTINE, TEXAS.—George W. Burkitt of Houston who owns the electric plant at Palestine is promoting the proposition of building a system of electric street railways here. He proposes to form a company with local business men and himself as stockholders to establish the proposed system. Application will be made to the city council for a franchise to cover the principal streets. D.

BELLINGHAM, WASH.—Within a short time the Stone and Webster interests will undertake the construction of the interurban railroad from Bellingham, thirty-five miles south through the Skagit valley. The people of Bellingham have subscribed $400,000 of the capital stock of the company which will build the line, and it remains only for the completion of details before construction work begins.

MANHASSET, L. I.—The New York and North Shore Traction Company has completed the power house on the Bay Side Meadows, which is to supply the current for the trolley lines from Flushing to Whitestone, and the extension to Manhasset. The poles have been placed along the route and will be set within a few weeks. It is announced that cars will be running from Flushing to Manhasset by August.

BRYAN, TEXAS.—The Bryan and College Interurban Railway Company has been granted a charter by the secretary of state. It has a capital stock of $20,000 and its principal office is at Bryan. The company is building an interurban railway between Bryan and the state agricultural and mechanical college at College, six and a half miles distant. The grade for the line is finished and track-laying is in progress. The cars will at first be operated by gasoline motors. D.

SACRAMENTO, CAL.—Charging that the Santa Fe Railroad, instead of promptly delivering in Marysville fifty ballast cars turned over to the corporation in Detroit, Mich., for that purpose, filled the cars with merchandise and used them for its own purpose and for the benefit of its patrons, the Northern Electric Railway Company has begun suit for $20,544 damages. The cars were needed by the electric company for the construction of its tracks between Chico, Marysville and Sacramento. A.

SPENCER, N. C.—Two cars, loaded with electric headlights for locomotives, have been shipped to this point to be installed on the engines of the Southern Railway, in accordance with a state law passed in January 1908. Most of the passenger locomotives have been previously equipped with the electric headlight. Some of the railroads operating in the state have petitioned the corporation commission for an extension of the time allowed in which to complete the equipment of their engines. L.

SEDALIA, MO.—The stockholders of the Missouri Interurban Railway Company, which proposes to build an interurban electric line from Sedalia to Prairie Home, Mo., met recently and elected the following board of directors for the ensuing year: A. W. Nelson and W. B. Kerns, of Bunceton; Henry Fricke, Sr., of Prairie Home; Frank Gimenden, of Cedron; Judge J. D. Starke, of Soleville; I. H. Gunn, of Otterville; W. B. Myer, of Smithton; E. W. Moore, of Kansas City, Kans.; W. L. Nelson, of Bunceton, and J. W. Mellor, of Sedalia.

SHERBROOK, QUE.—The by-law granting a twenty-eight-year franchise to the Sherbrooke Railway Company has been carried by a majority of 251. In return for the franchise the company promises to extend the system more than double what it is now, and will spend $500,000 in extensions and development of power plant. The company has an option on the waterpower of the Magog River, which runs through the city. Montreal capitalists are behind the scheme, and it is said that the system here will make connection with the proposed electric railway throughout the townships, starting from Montreal.

SAN FRANCISCO, CAL.—A party of surveyors has begun the final field work for the estimates on the extension of the Southern Pacific Company's electric line from Melrose to San Leandro. The preliminary surveys were made two years ago and, when the present work is completed, contracts will be let and the actual construction of the line started. This new line will open up an extensive country to suburban homes, passing through Melrose, Fitchburg, Highland, Elmhurst and San Leandro. Work is being rushed on the big power plant of the railroad at Fruitvale, which is to supply the current for operating the electric system.

CHARLESTON, W. VA.—That the proposed electric railroad connecting several towns in Tyler, Doddridge and Harrison counties will be constructed is indicated by a charter which was granted to the Middle Island Railroad Company, of Middlebourne, with a capital stock of $5,000, which is backed by men of sufficient financial standing to carry the project through. According to the charter, the road will be constructed from Sistersville by way of Middlebourne, Shirley and Center Point to Clarksburg. The incorporators are T. Moore Jackson, C. P. Stout, of Clarksburg; I. M. Underwood, John F. Shore, Thomas P. Hill, of Middlebourne.

GUADALAJARA, MEXICO.—The Guadalajara Light and Power Company expects to soon have its plans arranged for starting the construction of the proposed electric railway that is to be built between Guadalajara and Chapala, a distance of thirty-four miles. There has been considerable discussion as to whether the road should be operated by steam or electricity It is said that the federal government's subsidy of $400,000 is for the construction of an electric line. The Compania Irrigadora y Fuerza, which is also interested in the building of the proposed road, favored the use of electricity for motive power. The right of way for the entire distance has been donated. D.

CHEYENNE, OKLA.—For several weeks past an electric line has been surveyed, the profiles being drawn and the plans perfected. The roposition has now been submitted to the Commercial club and accepted. The railroad company is to have the line completed into Cheyenne and the rolling stock on it in twelve months from date. The company demands right-of-way through the county and $35,000 bonus, the bonus becoming due when the road is completed into Cheyenne and passenger and freight traffic in progress. The electric line will build from Oklahoma City, Hobart, Sayre to Cheyenne and will traverse the best agriculture sections of Oklahoma. The promoters are men of capital, including Mr. Van Brunt of New York state.

BRIDGEPORT, CONN.—The Connecticut Company is planning to spend nearly $750,000 in the Bridgeport district this year. An addition will be made to the power plant on Seaview Avenue, and with the new equipment the cacapity of the plant will be raised to 5,000 horsepower, an increase of about thirty-three and one-third percent. The new car barns, one of which will have a housing capacity of 110 cars, are being erected on Congress street. The investment in structural operations will amount to approximately $500,000. In addition, the company is planning to rebuild various sections of its system, and several extensions will also be made. Special work includes two miles and a half of double-tracking on the Milford line. Seventeen large double-track open cars will be delivered before the summer season begins.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

PLYMOUH, WIS.—Farmers east of here have organized the Plank Road Telephone Line with a capital of $2,500. C.

TURTLE LAKE, N. D.—The McLean County Telephone Company has been incorporated with a capital of $35,000. C.

SAUK CENTER, MINN.—The Northwestern Telephone Exchange Company will shortly commence rebuilding the local telephone plant. C.

EAST GRAND FORKS, MINN.—Jas. Gorman, city clerk, has taken bids for a twenty-year franchise to install a telephone system. C.

TACOMA, WASH.—The Evans-Dickson Telephone, with a capital stock of $2,000 has been incorporated by Llewellyn Evans and D. T. Dickson. A.

MANITOWOC, WIS.—The Schleswig Telephone Company has been organized with a capital of $5,000 to operate in Manitowoc and Calumet counties. C.

NEWMAN, CAL.—A new telephone company has been formed, known as the Sturgeon Telephone Company. J. F. Snyder is the president and Wm. Ede, the secretary. A.

LOS ANGELES, CAL.—The Pacific Telephone and Telegraph Company is erecting a three-story building at the cost of $150,000, for operating purposes in the Wilshire District. A.

STRONG CITY, ARK.—The Southern Telephone Company has rebuilt and greatly improved its exchange at this place. An up-to-date exchange has replaced the one formerly in use

NYSSA, ORE.—The Nyssa-Owyheo Independent Telephone Company, with a capital stock of $10,000, has been incorporated by O. J. Sinsel, W. Hoxie, S. Emison and H. Birdsall. A.

INDEPENDENCE, ORE.—The Home Telephone Company of Independence has been incorporated here by J. S. Bohannon, J. L. Hanna and W. L. Bice, with a capital stock of $14,000.

LAKE CITY, MINN.—Work is about to be commenced on changing the telephone system to an underground one. Bids have been taken for the erection of a new telephone exchange building. C.

WINONA, MINN.—The Mount Vernon Telephone Company, capital $15,000, Wm. Drenkhamm, secretary, has been incorporated to build a rural line in competition with the line of the former Rollingstone Company. C.

EATONTON, GA.—The Oconee Telephone Company has been chartered by H. R. DeJarnette and others who plan to build a rural telephone line that will connect with and operate through Southern Bell Telephone and Telegraph Company.

MINNEAPOLIS, MINN.—The Bell Telephone Company will expend about $800,000 in improvements in the Twin Cities and at the Head of the Lakes. Two new copper circuits and other improvements will be made in the long distance service. C.

HOUSTON, TEX.—The new south end telephone exchange, known as the Hadley exchange, of the Southwestern Telephone and Telegraph Company, was put in operation a short time ago. The switchboard was furnished by the Western Electric Company, of Chicago.

MALVERN HILL, VA.—The Henrico-Charles City Telephone Company organized with $5,000 capital stock, will construct a telephone line to connect with the Charles City telephone line at Malvern Hill Postoffice and extend to Richmond, Va., with branches to Varina and Fort Lee, Va.

BILOXI, MISS.—The Cumberland Telephone and Telegraph Company, Leland Hume, general manager, Nashville, Tenn., will expend $18,000 for improvements to its system. It will replace the open wires with new cables, and increase the capacity of its exchange. E. L. Doyle, local manager.

SPRINGFIELD, GA.—A state charter has been granted to the Effingham Telephone Company of this city, with a capital stock on $5,000. There are fifty or more incorporators, prominent among which are Sidney O. Newsom, Guyton; C. F. Berry, J. B. Simmons and E. W. Griffin, of Springfield, and L. D. Kessler, Blanford, Ga.

WARSAW, IND.—At a meeting of the directors of the Commercial Telephone Company March 31, it was decided to make extensive improvements to the plant and install some new equipment. A contract was made with J. W. Scott, to continue as general manager of the company for a period of five years. S.

MANITOWOC, WIS.—Capitalized at $5,000, in 100 shares of $50 each, the County Line Telephone Company has been incorporated to operate an inter-county system connecting Manitowoc and Kewaunee counties. The company's head offices will be at Tisch Mills, and lines will extend from that village in all directions into two counties.

EL PASO, TEX.—The Tri-State Telegraph and Telephone Company, has been organized with $1,000,000 capital stock; E. B. Fields, president, Denver, Col.; Philip Hamlin, vice-president; H. W. Bellard, general auditor. The new company takes over the El Paso interests of the Southwestern Telegraph and Telephone Company, of Dallas, Tex., and will expend $300,000 during the year for improvements, including either improvements to present building or erection of new structure, installation of cable system, etc. R. F. Morris will be general manager.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed by the California Telegraph and Telephone Company, capitalized at $100,000. The Company has been formed to construct and operate about 160 miles of telephone and telegraph service in Plumes and Lassen Counties. The directors are; Scott Hendricks, A. Mathews, G. H. Smith and Wm. E. Colby of San Francisco, W. H. Bissell of Livermore, W. E. Hills of San Francisco and J. O. McElroy of San Francisco. The wires will be strung from Susanville to Quincy, Crescent Mills to Genesee and Susanville to Honey Lake.

MEXICO CITY, MEXICO.—The department of communications of the federal government announces that all telegraph wires in this city will soon be placed underground. Most of these wires belong to the government telegraph system. The subway that was recently completed through the city for the purpose of bringing water in large mains for Xochimilco will be used for the purpose of stringing the main cables containing the wires. The new building of the government department of public works will soon be finished and the federal telegraph offices here will be located therein. D.

LINTON, IND.—Articles of incorporation have been filed with the Secretary of State by the Linton Mutual Telephone Company. The initial capital stock is placed at $10,000. The new company proposes to build telephone exchanges and telephone lines in Greene, Clay, Owen, Monroe, Knox, Sullivan and Vigo counties with the principal exchange and offices in Linton. Warren Tinstman, Likens Little, Thomas E. Harris, George P. Chapman and David R. Scott directors. The organization of this company is the result of opposition to an increase in rates charged by the Linten Telephone Company. S.

DALTON, GA.—The Mill Creek Telephone Company is making application for a charter, the capital stock of the company being $5.000. This will make the third incorporated telephone company in the county. The object of the company is to erect and operate a rural telephone line through Mill Creek valley. The incorporators are M. C. Kennemer, J. A. Griffin, C. A. Griffin, J. C. Kennemer, L. A. Dobson, Lewis Hall, Moody Love, Walter Babb, W. T. Hall, N. T. Kennemer, Walter Griffin, Roebuck Davis, W. D. Griffin, Hewitt Davis, Luther Kennemer, J. J. Montgomery, W. M. Babb, James Nuckolls, H. G. Roach and Jesse Walker.

ELECTRICAL SECURITIES.

The condition of the market has recently grown so apathetic as to verge on stagnation at times. A number of causes might be discerned for this state of things. The feeling of suspense due to the question of how the Supreme Court will settle the far-reaching problems involved in the American Tobacco and Standard Oil cases was disclosed in the nervous tremors of the market. A general belief has grown up that the American Tobacco decision would be handed down. Failing that result interest in the market flagged. The surfeit of new bond issues injected into the market is a contributory cause of its lethargy. United States Steel showed occasional strength on predictions of a coming increase in the dividend rate. Steel trade advices of continued decline in iron prices had a neutralizing effect. The statistical position of copper depressed the copper industrials. Labor disputes were numerous and settlements in some cases by wage advances left others still open with threats of strikes.

Oak Park Elevated, Chicago, during March carried a daily average of 47,794 passengers, an increase of 9.7 per cent. South Side Elevated traffic gained about 13 per cent. President Weston, of the South Side Elevated, has mailed the following to stockholders: "The business of the company in the first three months of this year showed a gratifying increase, but the directors consider it wise not to act on dividend matters before next July." The last dividend was three-quarters of one per cent for the quarter ending March 31, 1908.

J. P. Morgan & Company, and Lee, Higginson & Company have notified the holders of the consolidated mortgage five per cent gold bonds of the Metropolitan Street Railway Company, of Kansas City, maturing May 1, 1910, that in order to provide for the payment of the bonds at maturity, arrangements have been made for the issue under the consolidated mortgage of new coupon bonds, maturing May 1, 1913, and drawing interest at the rate of five per cent per annum, payable semiannually. Holders of the above mentioned bonds who wish to exchange the same for the new bonds, maturing May 1, 1913, must deposit their bonds ex-coupon, due May 1, 1910, at the offices of the firms mentioned on or before April 16, 1910. A cash payment of $20 for each $1,000 bond deposited will be made to the holders making such deposits, and coupons due May 1, 1910, if presented, will be cashed at the same time and place. Bonds not so exchanged will be paid in full on or after May 1, 1910, upon delivery to the Old Colony Trust Company, Boston, Mass.

DIVIDENDS.

Butte Electric and Power Company, one and one-quarter per cent on preferred, payable May 2.

East St. Louis & Suburban, preferred quarterly dividend of one and one-quarter per cent, payable May 2.

Edison Electric Illuminating Company of Brockton, semiannual dividend of $3.50 per share, payable May 2.

Manchester Traction, Light and Power Company, quarterly dividend of two per cent, payable April 15.

Mexican Light and Power Company, common quarterly dividend of one per cent, payable April 15, also regular half-yearly dividend of three and one-half per cent, on the preferred stock, payable May 1, to stock of record April 22.

Mexico Tramways Company; regular quarterly dividend of one and one-half per cent, payable May 1, to stock of record April 15.

Milwaukee Electric Railway and Light Company; preferred quarterly dividend of one and one-half per cent, payable April 30.

Niagara Falls Power Company; a dividend of $2 per share, payable April 25 to stock of record April 15.

Porto Rico Railways Company, Limited; quarterly dividend of one and three-quarters per cent, payable April 11.

NEW YORK

	April 11	April 4
Allis-Chalmers common	10	10
Allis-Chalmers preferred	36	36½
Amalgamated Copper	72⅝	74⅞
American Tel. & Cable	*80	*80
American Tel. & Tel.	135	138⅜
Broklyn Rapid Transit	76¾	76⅞
General Electric	149	149
Interborough-Metropolitan common	21⅝	22⅛
Interborough-Metropolitan preferred	56½	57¼
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	87	87
Mackay Companies (Postal Telegraph and Cables) prefd.	76	77⅞
Manhattan Elevated	134	136½
Metropolitan Street Railway	18⅝	18⅝
New York and New Jersey Telephone	123½	123
U. S. Steel common	82½	82⅞
U. S. Steel preferred	119¼	119
Western Union	71	—
Westinghouse common	63¼	64½
Westinbhouse preferred	115	115

*Last price quoted.

BOSTON.

	April 11	April 4
American Tel & Tel.	135	134⅜
Edison Elec. Illuminating	255	254
General Electric	149	149
Massachusetts Electric common	17	18
Massachusetts Electric Preferred	87	84½
New England Telephone	134*	135
Western Tel. & Tel. common	15	16½
Western Tel. & Tel. preferred	87	87

PHILADELPHIA.

	April 11	April 4
American Railways	45	45
Electric Company of America	12	12
Electric Storage Battery common	60	60
Electric Storage Battery preferred	60	60
Philadelphia Electric	15⅝	15¾
Philadelphia Rapid Transit	20⅞	22
Philadelphia Traction	86½	87
Union Traction	49	49¼

CHICAGO.

	April 11	April 4
Chicago Railways, Series 1	97	101
Chicago Railways, Series 2	30	30
Chicago Subway	2	2¾
Chicago Telephone	129½	132
Commonwealth Edison	115	117
Metropolitan Elevated common	15	16
Metropolitan Elevated preferred	52	52
National Carbon common	112½	115
National Carbon preferred	119	121

PERSONAL MENTION.

WILBUR C. FISKE, vice-president of the Hudson & Manhattan Company, who is in Europe, will return to New York in a few weeks.

SIR J. J. THOMSON has been nominated to represent Cambridge University, England, at the celebration in October, 1910, of the centenary of the University of Berlin.

A. E. KENNELLY, of Harvard University, gave a lecture on March 12, to graduate students of the United States Naval Academy at Annapolis, on "The Operation of Electric Motors from a Central Power Station."

BENJAMIN K. HOUGH has been appointed Boston sales manager for the Wisconsin Engine Company, of Corliss, Wis. He will have offices in the Oliver Building, Boston, and will represent the company in the sale of its apparatus in the New England States.

F. H. STEVENS, formerly central station heating engineer for the American District Steam Company, has accepted a position with Evans, Almirall & Company, of New York. Mr. Stevens' knowledge and wide experience in heating engineering especially fits him to give valuable service to the customers of this company.

CLAUDE E. HOFFMAN and MILTON D. RILEY, the former of the Allentown Electric Company, and the latter of the Boston office of the Nernst Lamp Company, have joined the sales department of the Toronto Electric Light Company. They will both give their time to securing commercial and sign lighting business.

LUDWIG A. KEMPER has resigned his position as general manager and treasurer of the Albert Lea Light and Power Company, Albert Lea, Minn., to become engineer on the staff of the Fuel Engineering Company, of Chicago. Mr. Kemper is a graduate of Delft University of Amsterdam and has been engaged in engineering and research work both in this country and on the Continent. For some time he was assistant electrical engineer of the Baltimore & Ohio Railroad.

PHILIP B. WOODWORTH AND CHARLES L. HOPKINS, the former the dean and professor of electrical engineering of Lewis Institute, and the latter of the Chicago bar, have recently become associated with Rummler & Rummler, patent lawyers, of Chicago. Mr. Woodworth will give special attention to application for patents on electrical inventions and to consultation in patent suits involving electrical questions. Mr. Hopkins has been engaged in the active practice of patent of patent law for the past seven years.

FRED H. GURTLER, of Chicago, Ill., who has become well-known to the electrical fraternity through his participation in their meetings as a convention reporter, won the gold medal in a stenographic contest held under the auspices of the Eastern Commercial Teachers' Association at Washington, D. C., on Saturday, March 26. This medal was won twice by S. H. Godfrey, of England, and once by C. H. Marshall, of New York, each contestant holding it for one year, the award, however, being retained by Mr. Gurtler as a permanent possession after the final contest. The contest was for men with less than ten years' experience, and upon solid matter. Mr. Gurtler made a record of 180 words per minute, with a four per cent error in transcription. His overall score was 173 words net, breaking the previous record of 165 words.

PAUL T. PAYNE, who has had charge temporarily of the Philadelphia office of the Dearborn Drug and Chemical Works, for the past two years, has returned to Chicago to do special work from the general offices. Mr. Payne has been connected with the Dearborn company for the past twelve years, having spent a number of years in their laboratory, before entering the sales department. Mr. Payne's assistant at Philadelphia, P. G. Jones, will assume the management of the Philadelpria office, covering eastern Pennsylvania, and W. J. Stokes will look after the Dearborn company's interests in Maryland and Virginia, with office at 809 American Building, Baltimore, Md. Mr. Stokes was formerly with the H. W. Johns-Manville Company. Both Mr. Jones and Mr. Stokes will work under the general supervision of the New York office of the Dearborn Drug and Chemical Works, at 299 Broadway, the headquarters of Grant W. Spear, vice-president and general eastern manager.

HENRY D. SHUTE was recently appointed to the position of acting vice-president of the Westinghouse Electric and Manufacturing Company of Pittsburg, Pa. For seventeen years Mr. Shute has been associated with this company, and his promotions from time to time have been of a character to give him a broad experience in shop, sales and executive work. Mr. Shute studied electrical engineering at the Massachusetts Institute of Technology, from which institute he was graduated in 1892. Following his graduation, he spent a year's study in Germany at the School of Mines, Clausthal, and also in Dresren. In 1893 he entered the works of the Westinghouse company at Pittsburg as an apprentice, spending his first two years in the testing department, following which he spent considerable time on erecting work, on laboratory work, under C. F. Scott, and later as assistant foreman of one of the departments of the works. After five years' service with the company, Mr. Shute took up work in connection with the sales department at the East Pittsburg office, and in 1901 was made the head of the alternating circuit division, correspondence department.

HENRY D. SHUTE.

Later he was advanced to the position of assistant to vice-president L. A. Osborne, which position he held at the time of his recent appointment. In this latter position he was active in the developments made in heavy electric traction and particularly in single-phase railway work. Mr. Shute is a member of the American Institute of Electrical Engineers, a member of the Engineers' Club, of New York, and most of Pittsburg's business clubs.

OBITUARY.

THOMAS H. SAVERY, president of the Harper's Ferry (W. Va.) Electric Light Company, died at his home in Wilmington, Del., on April 6, at the age of seventy-three years. Mr. Savery was one of the most prominent business men of Wilmington, and was also president of the Harper's Ferry Paper Company and the Shenandoah Pulp Company.

HENRY JOHNSON, a signal engineering expert, died recently at his home in Rahway, N. J., aged 72. He was born in England, and came to this country in 1886. He founded the Johnson Railroad Signal Company in 1888, and the Standard Signal Company in 1896. With his nephew, Charles R. Johnson, he was practically the first man to introduce scientific railroad signaling in this country.

PROPOSALS.

POST OFFICE, APPLETON, WIS.—The office of the Supervising Architect, Washington, D. C., will receive bids until May 12, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Appleton, Wis., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Appleton, Wis., or at the Supervising Architect's office.

POST OFFICE, NEWARK, OHIO.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until May 7 for the construction, complete (including plumbing, gas piping, heating apparatus and electric conduits and wiring), of the United States Post Office at Newark, Ohio, in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at Newark, O., or at the Supervising Architect's office.

POST OFFICE, SEWICKLEY, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until April 5, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Sewickley, Pa., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Sewickley, Pa., or at the Supervising Architect's office.

POST OFFICE, GREAT FALLS, MONT.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until May 10 for the construction (including plumbing, gas piping, heating and ventilating apparatus, electric conduits and wiring and standard clock system) of the U. S. Post Office and court house at Great Falls, Mont., in accordance with the drawings and specification, copies of which may be had from the custodian of site at Great Falls, Mont., or at the Supervising Architect's office.

LIGHTING MATERIAL, RICHMOND, VA.—Sealed proposals will be received at the office of the city electrician, Richmond, Va., until April 26, for furnishing and erecting poles, lamp fixtures, wire, transformers and other necessary material in the streets, parks and alleys of the city of Richmond for approximately 1,000 arc lamps and for lighting the public buildings of the city. Plans, specifications, proposal forms and form of contract are on file, and may be seen at the city electrician's office and at the office of E. W. Trafford, Consulting Engineer, Rooms 43-45 Chamber of Commerce Building, Richmond, Va.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

Date of opening.	Material.	Quantity.	Delivery at navy yard.	Schedule No.
April 19	Cable, lead, sheathed	2,066 feet	Philadelphia, Pa.	2373
	Lathe, engine, motor-driven	1	Philadelphia, Pa.	2367
April 26	Cable, telephone, etc.	Miscellaneous	Philadelphia, Pa.	2386
	Cable, single conductor	57,400 feet	Newport, R. I.	2389
	Supplies, electrical	Miscellaneous	Annapolis, Md.	2387
May 10.	Motors, induction	19	Mare Island, Cal.	2395

NEW PUBLICATIONS.

THE GENERATOR.—The March issue of the booklet of this name, published by the students of the New York Electrical School, contains an article of interest by Jack London, and several other items.

IRON ORE DEPOSITS OF VANCOUVER AND TEXADA ISLANDS.—The Department of Mines has published under this title a bulletin with maps, showing the location and composition of the deposits.

PROCEEDINGS OF THE AMERICAN INSTITUTE OF ARCHITECTS.—The report of the forty-third annual convention of architects, which was held at Washington, D. C., contains a complete account of the meeting and a reprint of the papers read there.

THE BULLETIN OF THE AMERICAN INSTITUTE OF ARCHITECTS.—The quarterly bulletin of the American Institute of Architects contains, besides report of various chapters, circular of advice relative to the principles of profession of practice and the canons of ethics.

MINNESOTA ENGINEER.—In the March number of this publication is reprinted a paper by W. T. Ryan on the systems of charging for electric power. The several methods of fixing charges are treated. Among other articles of an engineering nature is one on the maintenance of way by W. H. White.

BULLETIN OF THE UNIVERSITY OF WISCONSIN.—Bulletin No. 346 published at the University of Wisconsin, Madison, Wis., under date of March, 1910, contains an interesting article written by Charles Frederick Burgess and James Aston, entitled "The Strength of the Alloys of Nickle and Copper with Electrolytic Iron."

BITUMINOUS SHALES OF NEW BRUNSWICK AND NOVA SCOTIA.—The Department of Mines of Canada has published under this title a report on tests of oil shale, made with a view of ascertaining its economic value; especially as regards the yield of crude oil and sulphate of ammonia. Part two of this report deals with the position and character of the oil shale deposits of Canada.

THE JOURNAL OF THE UNITED STATES ARTILLERY.—In the January-February issue of this periodical there appears an interesting article on the mine commander's board by Captain L. S. Ryan of the coast artillery corps. This switchboard is made for the purpose of checking the mine firing operations during practice. This issue is also accompanied by an index to current military literature.

ADDRESS OF H. M. BYLLESBY AT COMPANY'S BANQUET.—The speeches made at the banquet of H. M. Byllesby & Company, held in the Auditorium Annex, Chicago, have been reprinted in pamphlet form. Mr. Dawes spoke on the development of the company, and of the early difficulties encountered. Samuel Insull spoke of the central-station development in Chicago, with which he has been so intimately connected.

BULLETIN OF THE UNIVERSITY OF KANSAS.—The Engineering Experiment Station of the University of Kansas, Lawrence, Kan., in Engineering Bulletin No. 1 publishes two interesting articles under the following captions: A Ballistic Electro Dynamometer Method of Measuring Hysteresis Loss in Iron and Voltage Regulation of Alternators. The former item is written by Martin E. Rice and Burton McCollum and the latter by Burton McCollum.

TERRESTRIAL MAGNETISM AND ATMOSPHERIC ELECTRICITY.—The March number of the publication of this name contains a short account of the trip of the non-magnetic vessel "Carnegie" which returned to Brooklyn on February 17 after having covered about 8,000 miles. The full report of the results of this cruise will be published in a later issue of the journal. L. A. Bowers' article on the magnetic disturbance of May 8, 1902, contains considerable data of interest.

MAGNETIC OBSERVATIONS AT SITKA, ALASKA.—The department of commerce and labor has published in book form the results of observations made at the coast and geodetic survey magnetic observatory at Sitka, Alaska, in the years 1905 and 1906. Careful readings were taken with a magnetograph of the Eschenhagen pattern, consisting of a recording apparatus and D, H and Z variometers, these data being given in the form of tables. Several magnetic storms were recorded, and magnetograms of the principal ones are reproduced.

REPORT ON GRADE CROSSINGS.—A report on the grade crossings in New York city and the need of changes in the grade crossing law, which was submitted to the public service commission of New York by Edward M. Bassett, has been reprinted in the form of a pamphlet. The importance of the elimination of grade crossings is dealt with and the methods of elimination are shown, as the booklet states there are a number of defects in the present law, and while the commission determines whether the street should go above or below the railroad, this determination is only made when the work is about to commence. It seems to provide that only one elimination should be made at a time. In conclusion, Mr. Bassett gives the reasons why the present grade crossing law is inadequate. Among these is the fact that the commission is not empowered except to a very limited extent to change the grade of a railroad.

NEW INCORPORATIONS.

CLEVELAND, OHIO.—The Enterprise Electric Construction Company has been incorporated with a capital of $25,000, by A. L. Oppenheimer, W. C. Caldwell, T. H. Smith, Edgar M. Bell, and Edward Younger.

NEW YORK, N. Y.—The Farkas Metallic Filament and Lamp Company has been incorporated to manufacture Tungsten lmps, with a capital of $75,000. The incorporators are: C. L. Wilson, J. Fromme, F. W. Baldwin, New York city.

DURHAM, N. C.—The Harris Machinery Company has been incorporated to conduct the business of electrical and mechanical engineers and to manufacture all kinds of tools and machinery. It was chartered with $25,000 capital, by C. W. Byrd, J. T. Broadway and others. L.

NEW YORK, N. Y.—The Kalish Electrical Company of New York city has been incorporated with the secretary of state to deal in all sorts of electrical supplies. The capital stock is $2,000, and the directors are Henry Daubert, Max Kalisch and Morris Kalisch, all of New York city.

INDUSTRIAL ITEMS.

THE HEANY COMPANY, THE HEANY LAMP COMPANY, and THE HEANY FIRE-PROOF WIRE COMPANY, New York city, announce that their offices will, after May 1, be located at 1733 Broadway.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a folder containing condulet talk No. 150. Enclosed with the folder is a slip showing "D. & W." fuses and a price list of Benjamin series tungsten fixtures.

THE ARNOLD COMPANY, Chicago, Ill., on its latest postal card, has an illustration showing a steel building in the course of erection. The steel work and electric cranes in the building, which was a large locomotive shop, were put up in eleven days.

THE ROBBINS & MYERS COMPANY, Springfield, O., has published its spring folder on Robbins & Myers standard fans. Several of the desk and wall types of oscillating fans are described and illustrated. Style B, C and D ceiling fans are also shown.

THE AMERICAN ELECTRIC COMPANY, Chicago, Ill., is mailing a bracket bulletin describing Burns' adjustable desk telephone brackets, and "Germproof" glass telephone mouthpieces. Collapsible brackets are also furnished for electric lights, mirrors, etc.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has in its March issue of "Graphite" an interesting article on the speed regulation of steam engines. There are also several recommendations of flake graphite and interesting experiences of users.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, Minneapolis, Minn., is mailing its monthly stock list to prospective buyers and purchasing agents. This is the first issue of the booklet and it will in the future be made a regular monthly publication.

THE ELECTRIC FIRELESS COOKSTOVE COMPANY, Hastings, Mich., is mailing folder on the use of its fireless cookstove. Several recommendations are given and a blank is enclosed for the convenience of those wishing to obtain these fireless cookstoves on trial.

THE DENVER GAS & ELECTRIC COMPANY, Denver, Col., has sent out an attractive calendar for the month of April. The text calls attention to the use of the electric vacuum cleaner for house cleaning. For decorative purposes a picture of a fishing girl is shown.

THE W. C. STERLING & SON COMPANY, Monroe, Mich., shows in a booklet recently sent out several views of the pole yards of the company. Some of the Government report on poles is reprinted, and the standard specifications of white cedar products are also reprinted.

THE EMERSON ELECTRIC COMPANY, St. Louis, Mo., prints in its April issue of the Emerson Monthly some advice on selling ceiling fans. The usual number of Emerson induction motors is shown and an article also appears on use of motors in connection with coffee mills and meet choppers.

THE REYNOLDS ELECTRIC FLASHER COMPANY, Chicago, Ill., reports that its entire line of flashers has been examined and passed by the National Board of Fire Underwriters. The company is sending out bulletin and price list No. 10, illustrating the single pole, and adjustable contact types of flasher.

W. N. MATTHEWS & BROTHER, St. Louis, Mo., are distributing catalogue No. 7, containing prices on Matthews money-saving specialties. Of general interest is the article on Heavy Wire Terminations by Anthony Graham. The catalogue also contains a wiring table and a considerable amount of useful data.

THE PHILADELPHIA ELECTRICAL AND MANUFACTURING COMPANY, Philadelphia, Pa., is mailing a bulletin on tungsten arc lamps and street lighting fixtures. Many types of lamps, reflectors and fixtures are listed and illustrated. A distribution curve taken with the Pemco Radio Wave Reflector is shown.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., has recently issued its bulletin No. 5132-1, describing its type EC belt-driven Hawthorn generators. A complete description of the construction and operation of its generators is given, with illustrations of the different types. Considerable space is given to a description of the individual parts of these generators.

THE PHOENIX GLASS COMPANY, New York, N. Y., tells in Catalogue D, recently issued, some of the reasons why Pheno Reflectors are especially suited to tungsten lamps. Several curves are given, showing the distribution obtained with different types of reflectors and for general information few notes on principles of correct illumination are included in the booklet.

THE ROLLER-SMITH COMPANY, New York, N. Y., gives a very complete description of its "E. A." (Electric Automobile) type instruments, in a recent publication. The most notable feature of these instruments lies in the resilient mounting which affords protection from the inevitable jar and vibration. The dial illumination, interchangeable shunts and other features are also described.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., is mailing blotters advertising its C-W motors, which are made in sizes from one-eighth to 4,500 kilovolt-amperes. The blotter has printed on it calendars of several months, pictures of two small motors and the well-known Crocker-Wheeler trade mark. The announcement is made that several hundred motors, ready for shipment, are carried in stock at the Chicago sales office.

THE DUNTLEY MANUFACTURING COMPANY, New York, N. Y., is mailing a folder illustrating the various uses which may be made of the electrically-driven Duntley pneumatic cleaner. This cleaner may be used, not only for cleaning purposes, but the current of exhaust air may be used by a lady for hair drying or even for operating a special massage vibrator. An attachment is furnished for expelling disinfecting fumes in the sick room or hospital.

THE NORTHWESTERN EXPANDED METAL COMPANY, Chicago, Ill., has incorporated in the form of a small booklet a great deal of data and interesting information regarding re-enforced concrete. Instructions are given for designing beams and for figuring on re-enforcement of kinds. The booklet contains an illustration of frame houses which have been overcoated with cement. The company has also published an interesting pamphlet on highway bridges.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has received the largest contract for mining and ore reduction machinery let since the late business panic. The contract, made through the London office, with the Union Miniere du Haut Katanga of Brussels, Belgium, comprises all of the details of the crushing, concentrating and smelting equipment for a copper producing plant of 900,000 tons yearly capacity including power house and electrical equipment to be built near Lake Tanganyika in the Congo territory of Central America. This order covers one of the largest and most perfectly equipped plants in the world, and was obtained in a wide competition because of the unique ability of an American company to supply all the machinery under a single contract.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has recently issued an attractive publication entitled "Transformer Manufacturing Facilities." The General Electric Company's facilities for the production of transformers have been increased to such an extent that the Pittsfield Works of the company now constitute the largest and best equipped transformer manufacturing plant in the world. This pamphlet illustrates various processes of transformer manufacture, and is sure to be of interest to all whose business is connected with electrical work. The number of this publication is 3919. Another bulletin which is being sent out at the same time is No. 4723, dealing with regulating pole rotary converters. These converters are adapted for a variety of purposes where a variable conversion ratio is required either to maintain constant direct current voltage with varying alternating current voltage, or to vary the direct current voltage as required. They are built in capacities of from 300 to 3,000 kilowatts, with a voltage range between 240 and 300, to cover the usual lighting circuit requirements.

DATES AHEAD.

Florida Electric Light and Power Association. Next meeting Tampa, Fla., April 21.

Iowa Electrical Association (April 20 and 21) and Iowa Street and Interurban Railway Association (April 20, 21, 22 and 23). Annual conventions, Sioux City, Ia.

Arkansas Association Public Utilities Operators. Annual convention, Pine Bluff, Ark., April 27, 28 and 29.

Southwestern Electrical and Gas Association. Annual meeting, Beaumont, Tex., May 10, 1910.

Ohio Mechanical, Electrical and Steam Engineers' Association. Next meeting, Cincinnati, Ohio, May 10.

Oklahoma Public Utilities Association. Next meeting, Sapulpa, Okla., May 9, 10 and 11.

Pacific Coast Electrical Exposition, San Francisco, Cal., May 21, 1910.

National Electric Light Association. Annual convention, St. Louis, Mo., May 23-28.

Maine Electrical Society. Next meeting, Portland, Me., May 25.

Mississippi Electric Association. Annual convention, Greenville, Miss., June 15 and 16.

Michigan Electrical Association. Annual convention, Port Huron ,Mich., August 16, 17 and 18.

Colorado Electric Light, Power and Railway Association. Next convention, Glenwood Springs, Colo., September 21, 22 and 23.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) April 5, 1910.

953,701. ALTERNATING-CURRENT TELEGRAPH SYSTEM. Carl Meyer, Charlottenburg, Germany. Filed October 18, 1907. A needle telegraph is operated by an alternating-current generator connected with a number of electric circuits joined in parallel. One coil is included in each circuit, and these coils are arranged at an angle to each other and have adjacent their poles a turnable keeper with a needle. An inductive resistance and a noninductive resistance are intercalated in one circuit, etc.

953,708. SEPARABLE ATTACHMENT-PLUG. Clarence D. Platt, Bridgeport, Conn. Filed June 26, 1909. The insulating base is formed in two sections and is provided with contact recesses in its sides.

953,709. DETACHABLE PLUG. Clarence D. Platt, Bridgeport, Conn. Filed June 26, 1909. Similar to the preceding.

953,748. VAPORIZING AND IGNITING MEANS FOR HYDROCARBON-LAMPS. Yasuke Kawasaki, Vancouver, British Columbia,

Canada. Filed November 6, 1908. Vaporization is effected by an electrically heated wire.

953,749. ELECTRIC MOTOR, GENERATOR, AND OTHER APPARATUS. Ralph D. Mershon, New York, N. Y. Original application filed February 1, 1904. Divided and this application filed December 3, 1906. An alternating current machine has a primary element provided with leads for consecutive even numbers of poles and for poles whose angular spacing is intermediate thereto, and a controller in circuit with the leads.

953,774. VACUUM RESISTANCE-FURNACE. Axel O. Appelberg, Schenectady, N. Y., assignor to General Electric Company. Filed July 2, 1906. The heating space has tungsten walls, and a refractory heater therein is of substantially pure tungsten.

953,782. SWITCH AND FUSE SUPPORT. William J. Gibbons, Philadelphia, Pa. Filed December 30, 1909. Comprises a conduit or tube having an opentopped reducing socket secured thereto, a base provided with means for the distribution of electric wires projecting from the tube and through the socket, the base having a boss which is adapted to extend into the socket, and means for closing the open top of the reducing socket.

953,809. INDUCTION-MOTOR. Robert B. Williamson, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electrictric Manufacturing Company, jointly. Filed March 1, 1907. A form of polyphase induction motor.

953,832. COMMUTATOR CONSTRUCTION. Fritz E. Hirt, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed January 30, 1909. Rings mounted on and insulated from the commutator are provided with slots or grooves.

953,834. LOCK-GUARD FOR INCANDESCENT LAMPS. Harvey Hubbell, Bridgeport, Conn. Filed December 13, 1909. 1. A guard for incandescent lamps comprises a rigid cage having a holding ring, a two-part locking plate having an angle flange provided with a groove adapted to receive the holding ring and an angle flange provided with a groove adapted to receive the rib on a lamp socket and means for locking the parts of the locking plate together.

953,841. HUMIDOR. Lazar Kahn, Shreveport, La. Filed May 10, 1909. An incandescent electric lamp is mounted within a transparent liquid receptacle.

953,859. ELECTRIC-ARC LAMP. Joseph A. Rignon, Gross-Lichterfelde-Ost, near Berlin, Germany. Filed September 4, 1906. Comprises a slidable carbon feeding tube having a longitudinal slot therein, a spring-controlled switch arm, a spring-held detent for the switch arm and a pin on the spring detent projecting into the slot on the carbon-regulating tube and operated by engagement with one end of the slot when an excessive downward motion occurs.

953,910. EQUALIZING TRUCK-MOUNTING FOR ELECTRIC TRACTION-CARS. Pearl N. Jones, Pittsburg, Pa. Filed September 18, 1908. The torque of the motor in starting the car abnormally increases the pressure on the back axle.

953,915. TROLLEY. George E. Lynch, Lynn, Mass., assignor to The Jeffrey Manufacturing Company. Filed April 26, 1907. A form of pantograph or toggle-joint trolley.

953,934. CONNECTOR FOR ELECTRICAL CONDUCTORS. John C. Vogel, Philadelphia, Pa. Filed April 28, 1909. Comprises a plurality of plates, connecting means adapted to vary the distance between the plates, and jaws on each plate spaced and adapted to interfit to grip a wire.

953,970. TELEPHONE-RECEIVER. Jay Noble, St. Louis, Mo., assignor of one-half to Charles W. Chamberlain, St. Louis, Mo.; Charles W. Chamberlain administrator of said Noble, deceased. Filed January 11, 1908. The receiver includes a diaphragm composed of a circular iron disk and one or more other circular iron disks of lesser and decreasing diameters superimposed and mounted upon the firstnamed disk and upon each other in the order of their decreasing diameters.

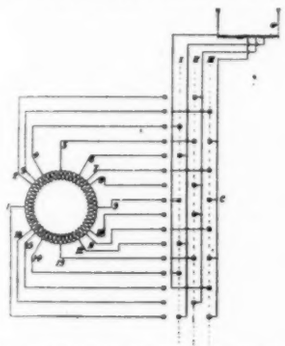
953,985. AUTOMATIC GAS IGNITION AND CONTROL. Louis G. Bartlett, Somerville, Mass., assignor to Auto-Lighter & Equipment Company, Boston, Mass. Filed May 11, 1909. Includes a normally open electric circuit for producing a spark to ignite the gas.

953,990. IGNITION APPARATUS. Ernst Eisemann, Stuttgart, Germany. Filed December 17, 1907. Comprises a distributing disk with its support, a toothed ring carried by the disk, a toothed member meshing with the ring another part forming a support for this member, and high-tension and low-tension contacts arranged on the opposite faces of the disk.

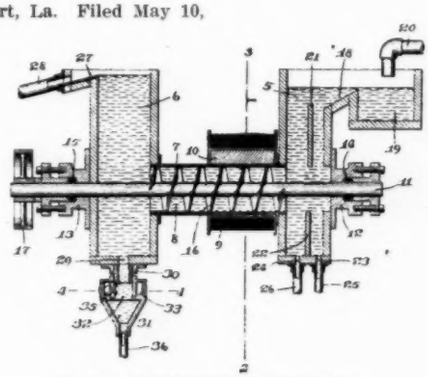
953,996. TROLLEY-WIRE CROSSING. Howard L. Griswold and Thomas Kerin, Oakland, Cal. Filed June 26, 1909. A trolley crossing comprises a base plate provided with downwardly inclined ends and a raised central portion, spaced apart side members carried by the plate, means carried by the side members for clamping a wire to the inclined ends of the plate, a grooved wire holder carried by the raised central portion of the base plate and provided with a base opening for the passage of the wire clamped to the ends of the plate.

954-014. TROLLEY-HEAD FOR ELECTRIC CARS. Charles S. Bayley, Auckland, New Zealand. Filed December 22, 1908. A trolley head has a pair of side cheeks extending rearwardly from the head and a recess within the forward end of the space between the cheeks, a tumbler fitting between the cheeks and having a wedge-shaped projection adapted to fit within the recess aforesaid, the tumbler being pivoted at its rear end to the cheeks, and a bearing block within the tumbler, in combination with a trolley fork provided with a spindle fitting the bearing block.

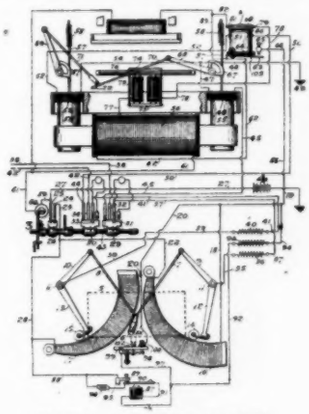
954,015. MAGNETIC SEPARATION OF ORE. Quincy Bent, Lebanon, Pa. Filed November 30, 1908. The process of separating pulverized ore consists in causing a stream of liquid carrying the ore to flow downwardly, magnetically drawing magnetic particles laterally from the stream and into a body of liquid extending laterally from and connected to the stream while the tailings descend with the stream, mechanically advancing the magnetic concentrates through the body of liquid and into an upwardly flowing stream of liquid, and permitting the magnetic concentrates to descend through the upwardly flowing stream while tailings in suspension are carried upwardly thereby.



953,749.—ELECTRIC MOTOR-GENERATOR.



954,015.—MAGNETIC SEPARATOR.



954,062.—TELAUTOGRAPH.

954,016. MAGNETIC ORE-SEPARATING APPARATUS. Quincy Bent, Lebanon, Pa. Filed November 30, 1908. Describes in detail the apparatus for the preceding.

954,035. ALTERNATING-CURRENT ELECTRIC ELEVATOR. David Larson, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed September 10, 1907. A motor control system comprises a plurality of electric motors connected in series, a starting resistance, and co-operating means including a speed governor for successively cutting out the resistance, inserting the resistance and connecting the motors in parallel, and again cutting out the resistance.

954,056. X-RAY SYSTEM. Homer C. Snook, Philadelphia, Pa., assignor to Roentgen Manufacturing Company. Filed July 20, 1907. The X-ray system includes supply conductors, a dynamo-electric converter for delivering fluctuating or alternating current, and associated high potential transformer having small magnetic leakage, an X-ray tube. and a synchronous high-potential rectifying switch causing the passage of all the current waves through the tube and all in the same direction.

954,062. TELAUTOGRAPH. George S. Tiffany, Summit, N. J., assignor to The Gray National Telautograph Company, New York, N. Y. Original application filed February 5, 1906. Divided and this application filed May 16, 1907. In combination with a main-line circuit are a relay controlled thereby, a second circuit, circuit-closing means controlled by the relay and in turn

controlling the second circuit, a third circuit and circuit-closing means therefor also controlled by the relay, the latter circuit-closing means comprising a pair of contacts loosely engaging each other, whereby, when vibrations occur in the main-line circuit, one is agitated relatively to the other and thus correspondingly interrupts the second circuit.

954,117. SOCKET FOR INCANDESCENT ELECTRIC LAMPS. Julius K. Lux, Syracuse, N. Y., assignor to Pass & Seymour, Inc., Solvay, N. Y. Filed May 16, 1907. The operative parts are inclosed within a protective casing of sheet metal.

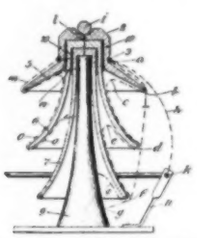
954,119. BATTERY-HOLDER. Carl T. Mason, Sumpter, S. C., assignor of one-half to George C. Warren, Sumter, S. C. Filed March 20, 1909. The cells are secured on opposite sides of a vertical board (mounted on a suitable base) having clamping bars and bolts, etc., for the cell terminals.

954,139. TROLLEY-RETRIEVER. Charles E. Schlagle, Wolcott, and Madison F. Hodge, Leavenworth, Kans. Filed January 4, 1909. Has pneumatic features.

954,150. TELAUTOGRAPH. George S. Tiffany, Summit, N. J., assignor to The Gray National Telautograph Company, New York, N. Y. Filed February 5, 1906. In combination with the transmitter and receiver of a telautograph station is master switch mechanism, in one position of which the receiver is "on" and the transmitter "off" with relation to a distant station, and in another position of which this condition of the two instruments is reversed, while in a third position thereof both instruments are "off" with relation to the distant station.

954,167. TELEPHONE BELL OR RINGER. Peter C. Burns, Chicago, Ill. Filed December 24, 1906. Comprises an electromagnet, a rocking armature normally polarized, a striker connected with the armature, bells to be struck by the striker in the rocking movements of the armature, a spring supporting the armature for rocking movement, having the armature secured thereto at separated points, and a support for the spring between the separated points.

954,168. ELECTRIC IGNITER OR BREAKER FOR GAS-ENGINES. Arthur F. Clarke, Butler, Pa. Filed August 24, 1908. A rotating



954,329.—INSULATOR-PROTECTING APPARATUS.

cam wheel causes a hammer to strike an arm for separating the electrodes.

954,176. ELECTRIC SWITCH-ALARM. Willibe F. J. Entrikin, Parkersburg, Pa. Filed June 19, 1909. An electric alarm is sounded when railroad switch points fail to operate.

954,298. TELEGRAPH INSTRUMENT. William M. Jackson, Gastonia, N. C. Filed May 27, 1909. A form of telegraph transmitter.

954,312. TROLLEY-WHEEL. Albert M. Levering, Philadelphia, Pa. Filed April 3, 1909. Flanges on the hub limit the pivotal movement of the wheel on the hub.

954,327. ELECTRIC CUT-OUT. Philip T. McNally, Mandan, N. D. Filed September 30, 1909. A branch circuit from the main circuit is provided with a solenoid; an auxiliary switch controls the solenoid circuit; a core for the solenoid has upwardly extending arms; means are provided for locking the auxiliary switch; a weighted lever operates the auxiliary switch and is adapted to be engaged by said arms for resetting the auxiliary switch; a release lever unlocks the auxiliary switch, and is actuated by the upward movement of the arms of the solenoids core subsequently to their engagement with the operating and resetting lever.

954,329. INSULATOR-PROTECTING APPARATUS. Lloyd C. Nicholson, Buffalo, N. Y. Filed January 25, 1909. The arrangement consists of an electrical conductor, an insulator therefor and an electrode connected with the ground and placed on the same side of the horizontal plane of the conductor as the insulator and lying outside of the insulator parts and arranged to divert the arc away from the insulator parts when a flashover and arc occur thereon.

954,342. ELECTRIC-RAILWAY SYSTEM. Edward W. Radius, Shelburn, Ind. Filed February 11, 1909. A form of third-rail system.

954,350. INSULATOR. Andrew J. Siler, Massillon, Ohio, assignor of one-third to Aaron V. Siler and one-third to H. Sumner Siler, Massillon, Ohio. Filed December 10, 1909. The insulator is made of a single piece of material comprising a body portion having a crown at one end which overhangs the body portion, and which is subdivided by a convex groove through the longitudinal center.

954,372. TELEPHONE-MOUTHPIECE. Hans H. Berg-Jager, Christiania, Norway. Filed August 11, 1908. A sound-wave concentrating device for telephone transmitters consists of a funnel-shaped member the smaller end of which is provided with a layer of a yielding material to fit the inner wall of the mouthpiece of the telephone.

954,402. TELEPHONE-REPEATER. Pietro Stragiotti, Hurley, Wis., assignor of one-fourth to Grith Thomas, one-fourth to Joseph Vercellini, and one-fourth to Frank Marta, Hurley, Wis. Filed August 11, 1908. A repeater circuit divides in two parallel circuits comprising two inductance coils established opposite on the same core; a second repeater has its coil bridged between two corresponding points of the parallel circuits.

954,403. TIME-RECORDER. Joseph G. Swallow, New York, N. Y. Filed August 6, 1909. Serial No. 511,537. In combination with a time recorder and a marker therefor are an electric switch and means whereby the switch mechanically actuates the marker.

954,407. VAPOR ELECTRIC APPARATUS. Charles O. Bastian and Albert E. Salisbury, London, England, assignors to The Cooper-Hewitt Electric Company. Filed August 17, 1903. A mercury-vapor apparatus, comprises a container for mercury, electrodes or contacts in the container normally connected by the mercury in the container, and means adapted to move the container and mercury and thereby strike the arc.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (furnished by the United States Patent Office), that expired April 11, 1910:

495,025. RAILWAY-SWITCH. Marcellin F. Dellac, New York, N. Y.

495,026. SPOOL FOR ELECTRIC COILS. George W. Demmick, Lynn, Mass.

495,030. MEANS FOR TELEGRAPHING. William H. Fahrney, Chicago, Ill.

495,035. ELECTRIC-RAILWAY TROLLEY. Frank Heath, Minneapolis, Minn.

495,038. MULTIPLE THERMAL CUT-OUT. Warren S. Hill, Boston, Mass.

495,046. ELECTRIC MOTOR. August Knoche, Eberfeld, Germany.

495,047. ELECTRICAL INDICATOR FOR RUDDERS. Charles V. Knowles, Somerville, N. J.

495,077. ELECTRIC-ARC LAMP. Addison G. Waterhouse, Hartford, Conn.

495,087. CENTRAL-OFFICE APPARATUS AND CIRCUIT FOR TELEPHONE-EXCHANGES. Edward J. Hall, Morris, N. J.

495,090. GRANULATED MATERIAL FOR TRANSMITTING TELEPHONES. William W. Jacques, Newton, Mass.

495,107. ELECTRODE FOR SECONDARY BATTERIES. George D. Coleman, Chicago, Ill.

495,125. ELECTRO-MAGNET. Simon H. Stupakoff, Pittsburg, Pa.

495,127. ELECTRIC-ANNUNCIATOR SYSTEM. Edmund R. Wilder, Kansas City, Mo.

495,138. MAGNETO-ELECTRIC MACHINE. Joseph N. McLeod,

495,139. MAGNETO-ELECTRIC GENERATOR. Joseph N. McLeod, Brooklyn, N. Y.

495,148. ELECTRO-MECHANICAL STEAM-ENGINE RECORDING INDICATOR. Reuben G. Collins, Dollar Bay, Mich.

495,176. ELECTRIC BATTERY. Frank M. Archer, New York, N. Y.

495,177. ELECTRIC BATTERY. Frank M. Archer, New York, N. Y.

495,179. SYSTEM FOR PROTECTING TELEPHONE APPARATUS FROM LIGHTNING. John J. Carthy, New York, N. Y.

495,180. TELEPHONE-GAGE. John J. Carthy, New York, N. Y.

495,212. PROCESS OF AND ELECTRICAL APPARATUS FOR TREATING ORES. John F. Wiswell, West Medford, Mass.

495,225. POTENTIAL-INDICATOR. George A. Lintner, Minneapolis, Minn.

495,229. SYSTEM OF ELECTRIC CONVERSION. Edwin W. Rice, Jr., Lynn, Mass.

495,240. INCANDESCENT LAMP. George H. Benjamin, New York, N. Y.

495,287. ELECTRIC ALARM-CLOCK. Thomas P. Adams, Rico, Colo.

495,306. GALVANIC BATTERY. Clyde J. Coleman, Chicago, Ill.

495,321. ELECTRIC STREET-RAILWAY SWEEPER. John W. Fowler and John Hutton, Brooklyn, N. Y.

495,393. APPARATUS FOR ELECTRIC WELDING. Charles L. Coffin, Detroit, Mich.

494,394. MACHINE FOR ELECTRICALLY WELDING METALS. Charles L. Coffin, Detroit, Mich.

495,443. TRAVELING CONTACT FOR ELECTRIC RAILWAYS. Charles J. Van Depoele, Chicago, Ill.

495,456. CONDUIT ELECTRIC RAILWAY. William R. DeVoe, Shreveport, La.

495,461 ELECTRIC-ARC LIGHT. Rudolph M. Hunter, Philadelphia, Pa.

495,463. ELECTRIC-ARC LAMP CARBON. George M. Lane, Asbury Park, N. J.

495,467. INCANDESCENT LAMP. Henry Green, Hartford, Conn.